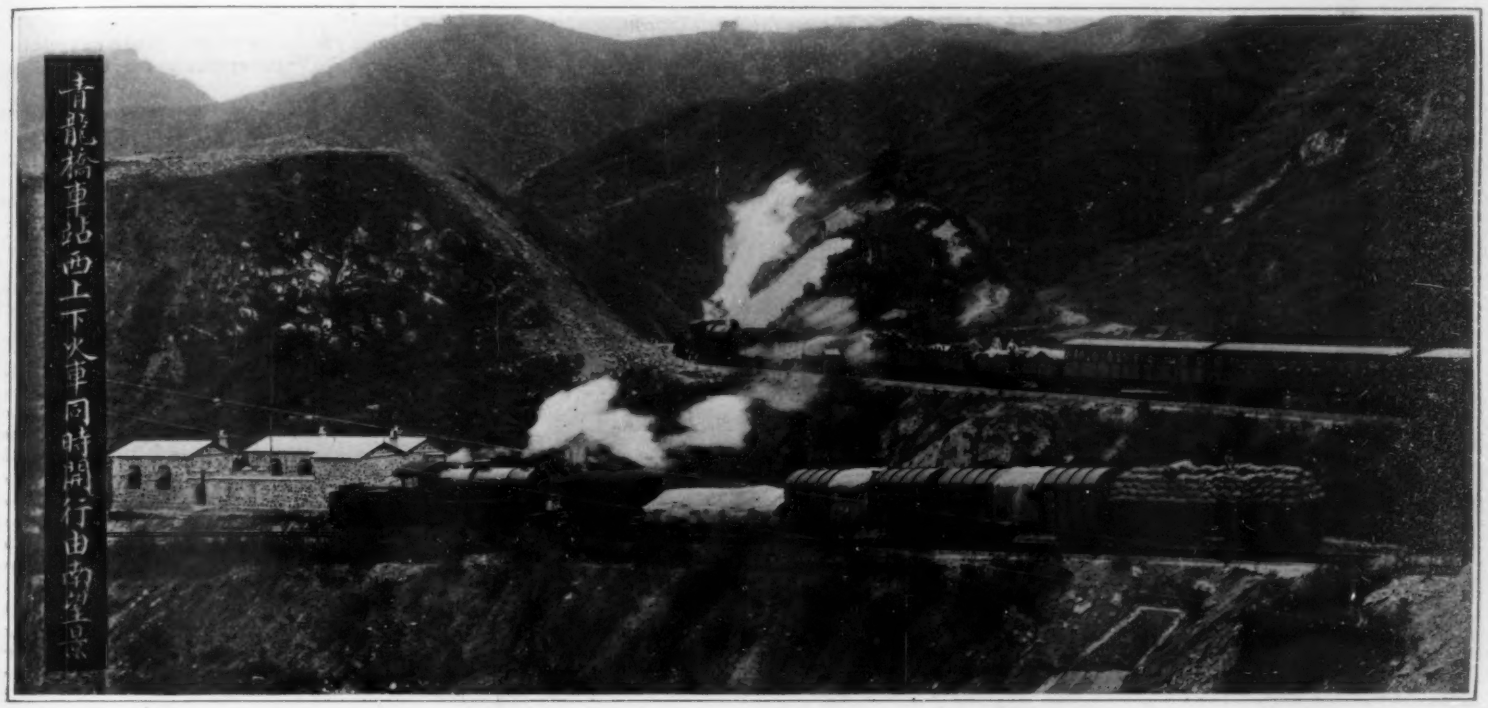
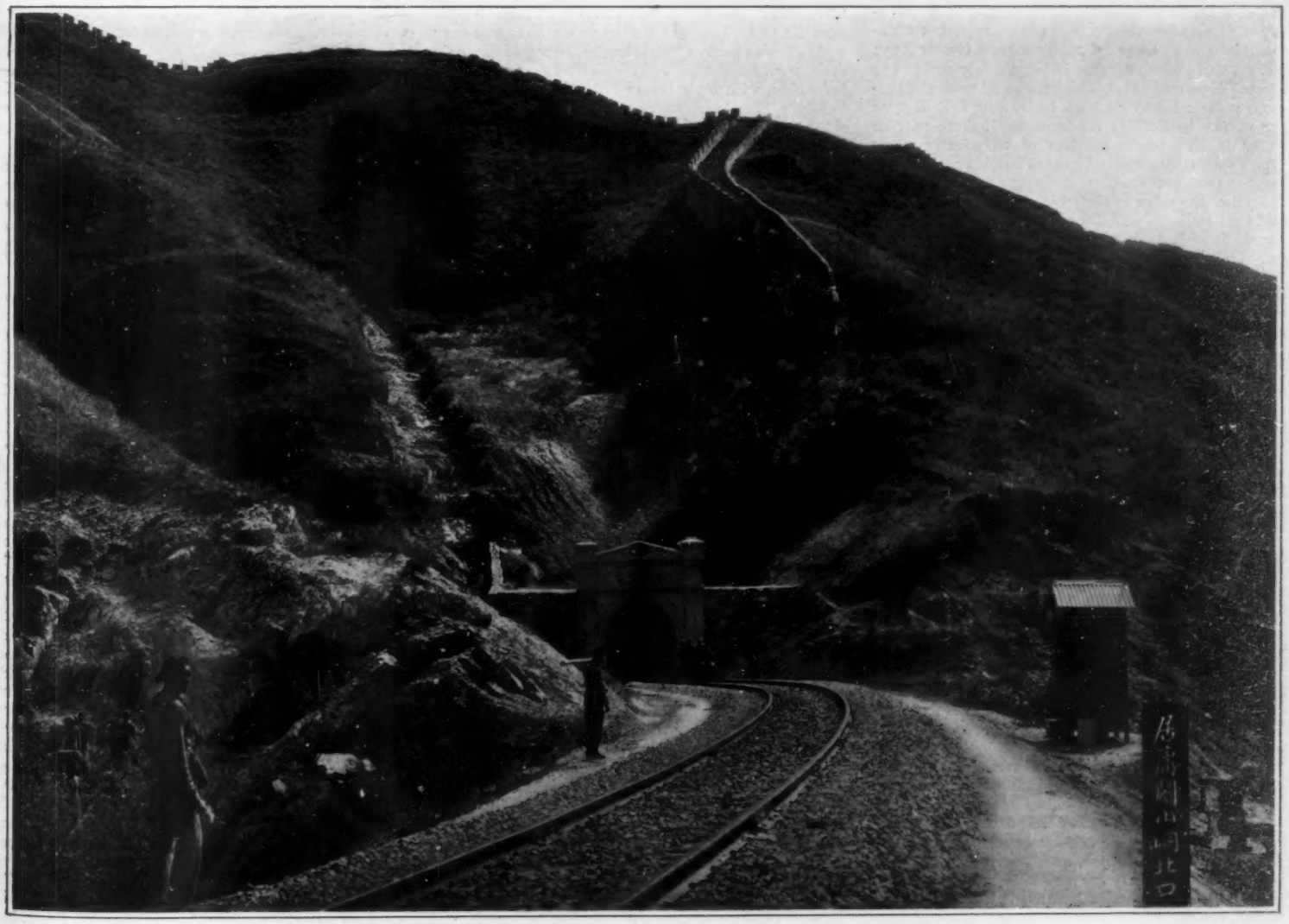
SIXTY-SEVENTH YEAR

SCIENTIFIC AMERICAN

THE WEEKLY JOURNAL OF PRACTICAL INFORMATION

VOLUME CV. NUMBER 19.] NEW YORK, NOVEMBER 4, 1911 [10 CENTS A COPY $3.00 A YEAR





The upper picture shows the switchback in Nankow Pass, the lower picture the tunnel under the great wall. The road was built by Chinese engineers and capital without foreign assistance.

THE PEKING-KALGAN RAILWAY.—[See page 409.]

SCIENTIFIC AMERICAN

Founded 1845

NEW YORK, SATURDAY, NOVEMBER 4, 1911

Published by Munn & Co., Incorporated. Charles Allen Munn, President; Frederick Converse Beach, secretary and Treasurer; all at 361 Broadway, New York

Entered at the Post Office of New York, N. Y., as Second Class Matter

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Subscription one year $3.00

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Greatest Naval Review in American History

THE avowed policy of the Navy Department in gathering together the mighty fleet which is now assembled in the North River is to stimulate the interest of the taxpayers, by showing them, in one imposing object lesson, just what it is that the country has to show for the millions of money which have been expended during the past twenty years in building up a navy. We can conceive of no more effective way of doing this. Tabular comparisons and descriptive articles can do something in giving an adequate idea of naval strength—photographs of the ships will deepen the impression; but the only effective way to produce a sufficient conception of the number, size and power of the ships of a fleet is to line them up for a great naval review of the kind that is taking place this week in the fairway of the North River.

There have been some notable reviews during the era of our new navy, such, for instance, as that during the Columbus celebration, at the Jamestown Exposition, and in Long Island Sound, off Oyster Bay; but none of these compares in the number and power of the ships assembled with this great marine spectacle at New York. It is an interesting fact that, as far as the battleships are concerned, there will be found in line representatives of practically every type of American battleship that has been built during the past two decades.

Taking the ships in their historical order, we have first the "Indiana" and "Massachusetts," whose keels, together with that of the sister ship "Oregon," were laid in 1891. These ships, carrying four 13-inch and eight 8-inch guns on a displacement of a little over 10,000 tons, embodied a distinctive characteristic which has marked all American battleship design, namely, the exceptional weight and power of the batteries. Recently reconstructed and furnished with the modern system of range-finding, with their gun mechanisms considerably modernized, these ships are still valuable for the second line of mobile defenses. The "Iowa," of 11,346 tons displacement, date 1893, was our first ship to carry the 12-inch gun. She mounts four 12-inch and ten 4-inch guns. The next class, "Kearsarge" and "Kentucky," 1896, is not represented in the review, nor are the three vessels of the "Alabama" class. The "Maine," however, is present, as representative of a class of three ships (date 1899), the other two being the "Missouri" and the "Ohio." In the "Maine" class, as in the "Alabama" class of three ships which preceded, the 8-inch gun is missing, and a weaker battery of 6-inch guns is substituted. On a displacement of 12,500 tons, the "Maine" carries four 12-inch and sixteen 6-inch guns.

Next in chronological order is the "Georgia" class, of which four ships, the "Georgia," "Nebraska," "New Jersey" and "Virginia," are present. It was around these ships that a fierce technical controversy raged, the bone of contention being the superposed turret, in which a pair of 8-inch guns is mounted above a pair of twelves, within a single double-deck turret. The "Georgia," 1901, is a vessel of 15,000 tons displacement and 19.25-knot speed. She mounts four 12-inch, eight 8-inch, and twelve 6-inch guns, a truly formidable battery; and it is but fair to state that, in spite of the limitations of the double-deck turret, certain of the heavy rifles so mounted have made some of the finest scores during target and battle practice.

The largest class among the battleships is that which is named after the flagship of Admiral Osterhaus, the "Connecticut." Six representatives of this design are present, the "Connecticut," "Louisiana," "Kansas," "Minnesota," "New Hampshire," and "Vermont." The keels of these ships were laid in 1903 and 1904. They displace 16,000 tons, and they all attained their trial speed of 18 knots, and generally exceeded it by from half to three-quarters of a knot. They carry an unusually heavy battery of four 12-, eight 8-, and twelve 7-inch guns, the last named being an armor-piercer up to considerable ranges. The completion of the "Connecticut" class marked the close of the pre-dreadnought period. The "Idaho" and "Mississippi," 13,000 tons, 17 knots, are small editions of the "Connecticut."

Of about the same displacement as the "Connecticut," but distinguished by the fact that they were the first all-big-gun ships to be built for our navy, are the "Michigan" and the "South Carolina," work upon which commenced in December, 1906. In the history of the dreadnought period these two ships will be distinguished as having been the first to introduce an arrangement of the big-gun battery, which was destined ultimately to be adopted in every navy of the world. The method may be described as "center line position and superposed firing," in which all guns are placed on the longitudinal axis of the ship, and the turrets are mounted in pairs, enabling the inboard turret to fire its guns above the roof of the turret farther outboard. Severely criticised at its first presentation, this system presented advantages so fundamental that it was bound ultimately to be accepted as the most effective compromise for securing broadside fire for every gun, and a sufficient concentration of end-on fire. The displacement of the "Michigan" and "South Carolina" is 16,000 tons. Their speed is over 18¾ knots, and they carry eight 45-caliber 12-inch guns in four turrets, and a torpedo defense battery of twenty-two, 50-caliber, 3-inch guns, which make up what they lose in weight and penetration by being carried in a lofty superstructure where they can be fought in any weather.

The first dreadnoughts, in size as well as gun power, to be built for our navy, are also moored in line. These are the "North Dakota" and the "Delaware," 1907. Our naval constructors were particularly happy in drawing the lines of these very fine ships. Visitors to the fleet will take note of the lofty forecastle deck with its pair of turrets carrying their guns 32 and 38 feet above the water line; and they will note also the long unobstructed sweep of the main deck, with its three turrets and six twelves. These two ships, with their larger sisters, the "Utah" and "Florida," are to our thinking, the handsomest battleships afloat to-day. On a displacement of 20,000 tons, they combine a speed of 21 knots with a battery of ten, 45-caliber, 12-inch and fourteen 5-inch guns, and the large bunker capacity of about 2,700 tons of coal. The "North Dakota" has the distinction of being the first turbine-driven battleship built for the United States Navy. The "Utah" and "Florida," 1909, fresh from the builders' hands, are the largest ships in the review. They embody certain valuable improvements over their predecessors. The displacement has been increased to 21,825 tons. Though the contract speed is a quarter of a knot less, on trial both ships made over 21 knots. They carry a battery of ten 12-inch, 45-caliber guns, and sixteen 5-inch.

The armored cruiser is represented by two fine vessels of the pre-dreadnought period, the "Washington" and "North Carolina," date, 1903 to 1905; displacement, 14,500 tons, speed 22¼ knots, and armament four 10-inch and sixteen 6-inch guns. These shapely vessels compare favorably with foreign armored cruisers of their time; but we could wish that the United States Navy included three or four dreadnought-cruisers of the "Inflexible" and "Von der Tann" type, whose speed and power may possibly prove to be the deciding factor in the next naval war.

Another interesting cruiser is the scout "Salem," one of three fast scouts, the "Birmingham," "Chester" and "Salem," of 3,750 tons displacement, and from 24 1/3 to 26 1/2 knots trial speed. In view of the fact that foreign navies have armored cruisers of greater speed and seaworthiness, opposing 12-inch guns to the 5-inch pieces of our scouts, it can be seen that they have been outbuilt and their field of usefulness must be extremely limited.

Very imposing is the fleet of twenty-two destroyers. Swift and sea-worthy, having the power and size to enable them to steam far and fast, even in heavy weather, these vessels must be considered as among the most efficient, both in themselves and in the way in which they are handled, of the unarmored craft of our navy. They range in size from 420 to 740 tons, and in speed from 28½ to 32½ knots. The largest of them are nearly 300 feet in length, and their full-load displacement reaches 900 tons.

Probably nothing in the review will excite more lively interest than the eight submarines, among which are included some of the latest and most successful of these craft. It is unfortunate that such an atmosphere of mystery and risk surrounds these vessels in the public mind. The maneuvers of the past year have shown them to be thoroughly seaworthy, absolutely under control, and possessed of powers of attack far beyond the common estimate of their abilities.

The weak point in the composition of our navy is its great deficiency in auxiliary ships, such as colliers and supply ships of the many and various kinds that are necessary to render the operations of a fleet effective. The eight auxiliary vessels present at the review are all converted merchant vessels, and to this extent they are necessarily makeshifts. Congress should make liberal appropriations both for supply ships and for large and speedy colliers, both types being designed specially for their several duties.

Urgently needed, also, is a large addition to our fleet of destroyers. The proportion of destroyers to battleships, as estimated by the leading naval powers, is four to one. Hence the battleships now in the North River should be accompanied by some one hundred of these craft. As a matter of fact, we have but thirty-six torpedo-boat destroyers in the whole navy.

Prizes for Military Aeroplanes

THE present war in Tripoli has greatly strengthened the interest displayed by the Italians in the possibilities of the aeroplane both as a means of reconnaissance and as a weapon of offense. Its value in the former capacity has been proven beyond a peradventure. In spite of the rapidity of its passage above fortifications and lines of troops, trained observers are able to obtain not only clear mental impressions of the details of arrangement, but they also have time to secure sketches and photographs, while their speed and the great altitudes at which they can fly render them practically invulnerable.

The recent maneuvers of the French aviation corps at Verdun were considered by military experts to have been brilliantly successful. Three aeroplanes, following two different routes, flew from the fortress of Verdun to the town of Tours, which was supposed to be in a state of siege. The machines covered 115 miles without descent, flying so high (from 3,000 to 5,000 feet) as to seem mere butterflies. Their observers noted every detail of the defensive works and the movements of troops, while they could easily have destroyed the captive balloon, which was the only measure of defense taken against them.

Besides its many apparent advantages, one authority mentions, also, that this means of scouting is more humane than older methods, since fewer scouts are needed, and their probable loss of life is far less.

As a weapon of offense, however, the aeroplane is still in a state of development, and there are divergences of opinion as to its ultimate effectiveness. Capt. Hildebrandt, the well-known German expert, is of the opinion that it can never take the place of the dirigible in destructive operations on a large scale. But the enormous comparative cost of the dirigible, with its greater vulnerability, and the difficulties of control when landing in boisterous weather, operate against its use, and give an impetus to the efforts being made to increase the offensive potentialities of the aeroplane.

An important step has lately been taken toward the furtherance of this aim. In a formal letter to the President of the Aero Club of France, a fund of 150,000 francs ($30,000) has been proffered by MM. Michelin to provide prizes for successful bomb-dropping from aeroplanes. The fund provides for four prizes. To win the first prize of 50,000 francs the aviator must carry five projectiles weighing 44 pounds each; must fly at a height of 650 feet or more; and must place his missiles, one by one, within a circle having a radius of only 32.8 feet. The prize will be awarded to the contestant placing the largest number of projectiles in the circle during a single flight. The second prize, of 25,000 francs, is to be won by the man who, flying at a minimum height of 3,280 feet, shall place the most projectiles within a rectangular area of 328 x 32.8 feet. The time limit for these two prizes expires August 15th, 1912. The limit for the remaining prizes is extended to August 15th, 1913, and the donors reserve the right to modify the conditions for these.

The results of the contests for the new Michelin prizes will be awaited with much interest especially since an American officer, Lieut. Riley W. Scott, has gone abroad with his bomb-dropping apparatus (described in our last issue), which is to be entered in competition.

The Heavens in November

Four Comets Now in Sight

By Henry Norris Russell, Ph.D.

IT IS a very unusual thing that two comets, conspicuous to the naked eye, should be in sight at once. Such was the case, however, during the early part of October, when Brooks's comet was still a prominent object in the evening sky, and could also be seen before dawn, while farther to the south, in the morning sky, appeared another comet, of about the same brightness.

This latter object, discovered by the Russian astronomer Beljawsky on September 28th, reminds one in some ways of the great comet of January, 1910. Both were first observed as conspicuous naked-eye objects, rising shortly before the sun, and in both cases it was some time before satisfactory observations of position could be obtained, owing to the difficulty of seeing the nearby stars (which serve as reference points) upon the brightly illuminated morning sky.

A satisfactory orbit has by this time been computed, which explains why the comet was not seen sooner. It was in perihelion, at a distance of 28 million miles from the sun, on October 10th. Three weeks earlier it was more than twice as far from the sun, and probably less than one-quarter as bright. Moreover, its orbit stands almost at right angles to the plane of the ecliptic, so that it came from far south of the sun, and remained south of him (and hence in a very unfavorable position for northern observers) until about the time of discovery. At the date of writing it is in the evening sky, in 15 hours R. A. and 3 degrees south of the equator, and sets about 1½ hours later than the sun. On November 1st it will be almost due west of the sun, at a distance of some 25 degrees, and will still be observable; but, being already twice as far from the sun as at perihelion, and remoter, too, from the earth it will not be at all conspicuous, though it may be followed telescopically by southern observers for some time. Brooks's comet, which passed north of the sun on October 12th, at a distance of 36 degrees, is now a fine object in the morning sky. On November 1st it will be almost exactly on the celestial equator, not far from the star Gamma Virginis, and will rise fully two hours before the sun.

Its head, at last reports, was of the second magnitude, and its tail 20 degrees long, so that it will be well worth getting up to see, before the moon comes into the morning sky. Later in the month it recedes from us and from the sun, gets more and more nearly behind the latter, and disappears.

Still a third comet, discovered by Quenisset on September 23rd, is under observation. This one requires the aid of a field glass, at least, to make it visible. Its orbit is likewise highly inclined to that of the earth, but its distance from the sun at perihelion (on November 12th) is 72 million miles. At the beginning of November it is in 15 hours 45 minutes R. A. and 13 degrees north declination, and is moving south and a very little east, at the rate of 1 degree a day. This puts it 1½ hours west and 27 degrees north of the sun, so that it will be easily observable. It will probably be of about the seventh magnitude.

A faint periodic comet, first discovered by Borelly in 1905, has been reobserved on its return at certain southern observatories, but, being visible only in the most powerful telescopes, is of little interest to us.

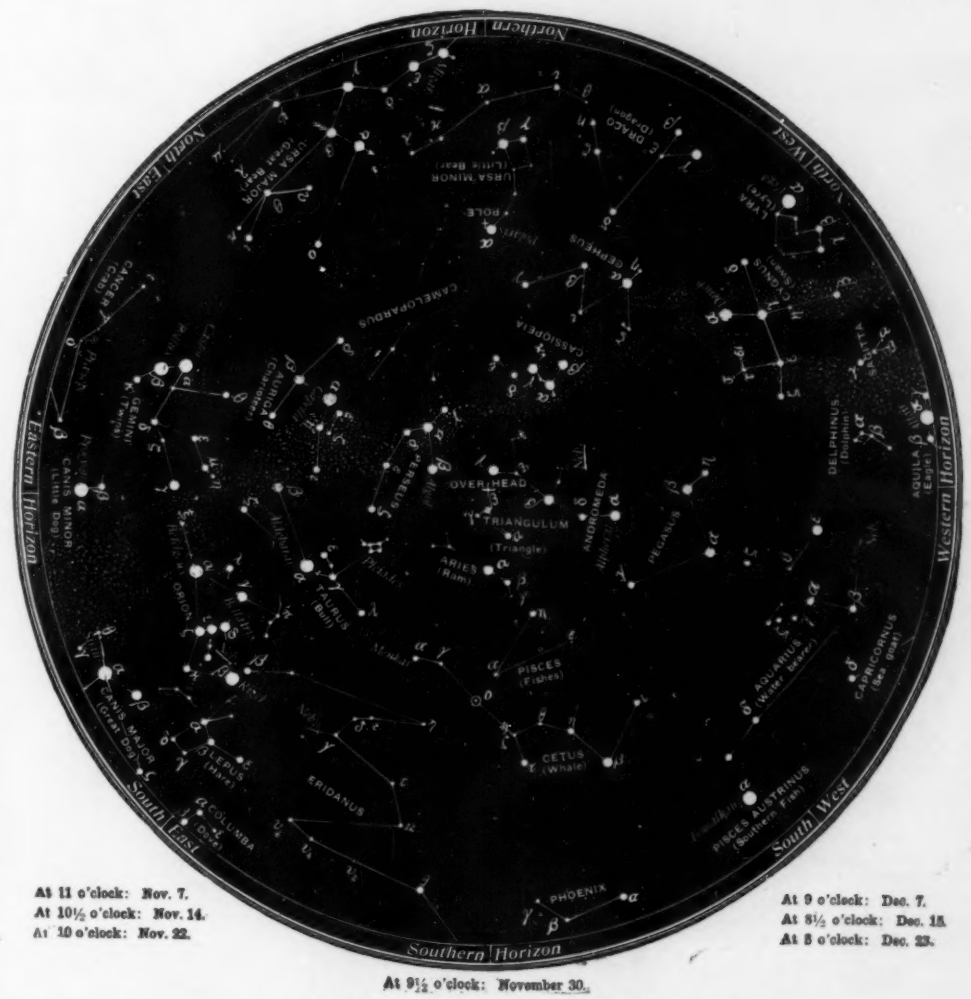
The Heavens

With the present month, a slight change is made in the manner in which the star-maps of our annual sequence are used. Up to this time they have shown the appearance of the sky during the early evening in the month of publication, or the later evening hours of the preceding month. There are some advantages in choosing our assumed hour of observation a little later, so that the same stars may still be seen, before twilight, during the month following that for which these articles are published. From this time, therefore, our map will show the sky as it appears at 10:30 P. M. in the middle of the month of publication, and at 8:30 in the middle of the next month.

At these hours, then, in November or December, the heavens will appear as the accompanying map shows them. The Great Bear is low in the northeast, and Draco and Ursa Minor are beneath the pole. Cassiopeia and Cepheus are high up, just west of north. The brilliant Vega is setting in the northwest, and the cross of Cygnus stands erect, just to the left. The great square of Pegasus is the most conspicuous object in the western sky. Below it lies Aquarius, the constellation represented in our initial letter. This is one of the ancient signs of the zodiac, but contains no bright stars. Its most prominent group is a small Y (lying on its side) formed by the stars ζ, γ, and two others. This represents the water jar from which the Water-Bearer pours forth a stream marked by small stars too faint to be shown on our map, which flows downward, first to the right and then to the left, till it is swallowed by the Southern Fish, whose one bright star, Fomalhaut, is now low on the southwestern horizon. Of telescopic objects in Aquarius, we may mention the star ζ Aquarii (the middle one of the Y) a fine slow binary pair, separated by 3.5 seconds, whose period of revolution is probably a couple of thousand years.

Due south is Cetus, with one conspicuous star, β, standing very much alone about 30 degrees northeast of Fomalhaut. North of this is the inconspicuous group of Pisces, and the small but brighter one of Aries, with Andromeda still higher, right overhead.

The most brilliant region of the whole heavens is now well up in the southeast, where Sirius has just risen. Orion is resplendent above him, and Taurus shines still higher up. Mars and Saturn, which are at present between Taurus and Aries, add their luster to the spectacle. Procyon is low down in the east, and Castor and Pollux are a little higher, and more to the north. Above them, the bright Capella marks the place of Auriga, and above this, almost overhead, is Perseus. Minima of the variable star Algol—may be observed at 8 P. M. on the 1st, 5 P. M. on the 4th, 10 P. M. on the 21st, 7 P. M. on the 24th, and so on; the eclipses coming on every third day, about 3 hours 10 minutes earlier by the clock.



At 11 o'clock: Nov. 7.
At 10½ o'clock: Nov. 14.
At 10 o'clock: Nov. 22.

At 9½ o'clock: November 30.

At 9 o'clock: Dec. 7.
At 8½ o'clock: Dec. 15.
At 8 o'clock: Dec. 23.

NIGHT SKY: NOVEMBER AND DECEMBER

The Planets

Mercury is evening star throughout November, but, being very far south of the Sun, is ill placed for observation. Toward the end of the month he may perhaps be seen as he sets about 5:45 P. M.

Venus is morning star, at her very best, rising in the neighborhood of 3 A. M. and getting high in the southeast before dawn. On the 16th she is in conjunction with the crescent Moon, and, when nearest, at about 2 P. M., will be less than a degree away. By this hour both will be low in the west, so, if we wish to see the planet in the daytime (which is perfectly easy if the sky is really clear) we will do better to go out in the forenoon, and look a couple of degrees east of the Moon.

Mars is in opposition on the 24th and is visible all night. He is farther from us than he was two years ago—47 millions miles—but his high northern declination makes up for this, by carrying him high in the sky, where we have to look through less of our own unsteady atmosphere in order to see him.

To find him, it is only necessary to look eastward, and pick out the brightest and reddest thing in sight. With even a small telescope, he shows a considerable disk. The darker markings which are the most conspicuous features of the Martian surface can be seen fairly well with small telescopes, and these will also show that the "polar cap" is at present inconspicuous, most if not all of the polar snows having disappeared during the long summer of the Martian southern hemisphere, now near its close.

Jupiter is in conjunction with the Sun on the 17th, and is invisible throughout the month.

Saturn is just past opposition, in Aries, about 20 degrees west of Mars, and is finely placed for observation, with the ring-system opened widely. The contrast in color and brightness between the two planets is conspicuous to the naked eye.

Uranus is in Sagittarius, too low in the west at sunset to be well seen. Neptune is in Gemini, coming to meridian about 4 A. M. in the middle of the month.

The Moon is full at 11 A. M. on the 6th, in her last quarter at 2 A. M. on the 13th, new at 4 P. M. on the 20th, and in her last quarter at 9 P. M. on the 28th. She is nearest us on the 8th, and remotest on the 24th. She is in conjunction with Saturn on the 6th, Mars on the 7th, Neptune on the 11th, Venus on the 16th, Jupiter on the 20th, Mercury on the 22nd, and Uranus on the 25th.

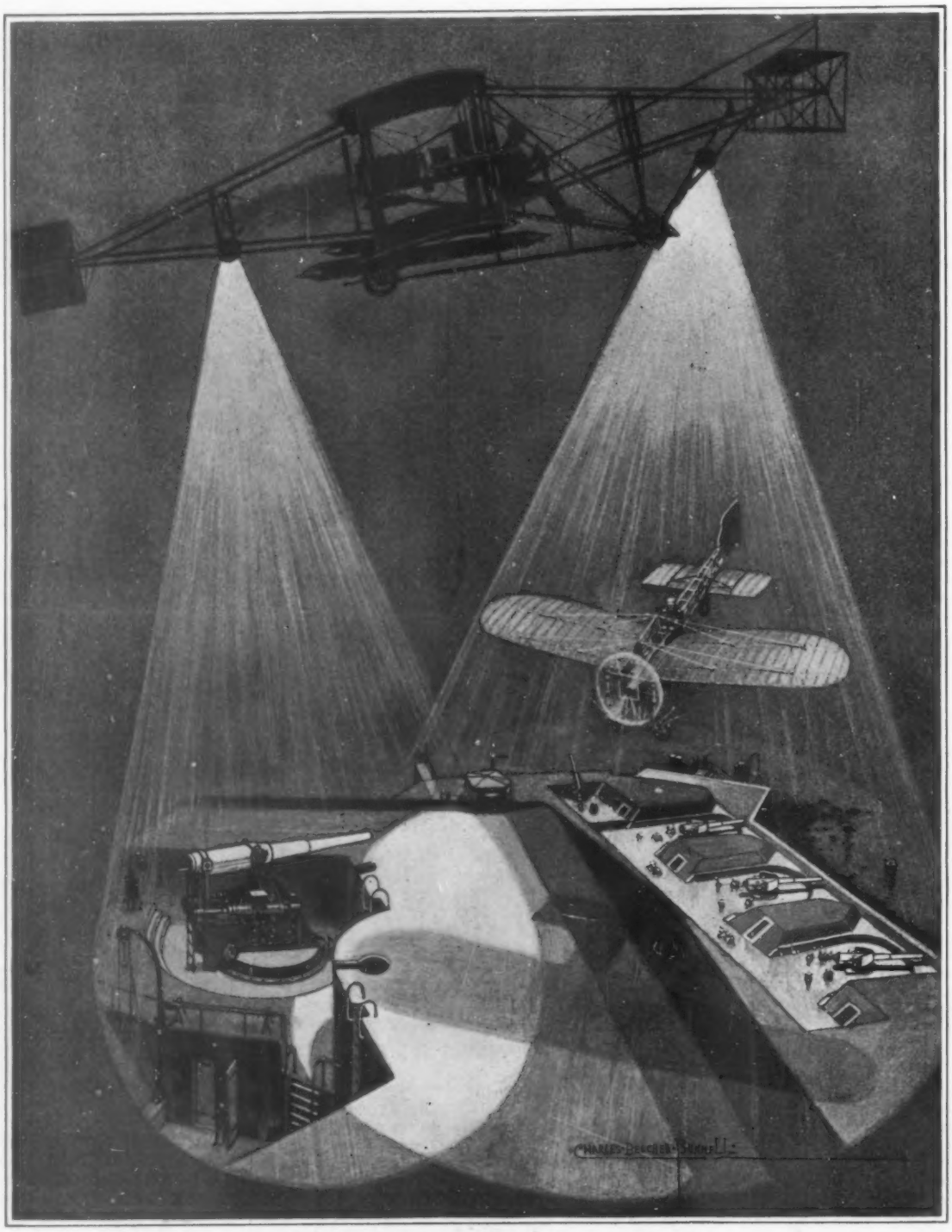
Princeton University Observatory.

Photographic Scouting at Night

An Artist's Contribution to an Aeronautic Problem

WHILE the matter of using aeroplanes as actual fighting units in warfare is still in dispute, there is no question that they will play a most important part as scouts. In fact, they have actually been used in this capacity by the Italian army in Tripoli. In the very earliest days of aeronautics, this use of the aeroplane was suggested, and pictures were published showing an army scout making sketches from an aeroplane. A later idea has been to use a camera so as to facilitate the work of the scout. It has occurred to the artist whose drawing is reproduced herewith, that photography under such circumstances would be rather difficult, owing to the fact that the machine would have to be brought within comparatively small elevation above the fortifications that were to be photographed, and would thus be an easy target for the gunners below. He believes that night photography would be better; for then the aeroplane could steal into position over the fortifications, and flash its light upon them for a few brief moments while pictures were taken. The best camera for the purpose would be one adapted to take a Kinematographic series of pictures. Out of the set of pictures thus taken, there would, he argues, surely be a few which would show the fortifications to good advantage as the aeroplane passed over them. The brief interval during which the searchlight of the aeroplane would play upon the fortifications might not be sufficient to enable the gunners to take accurate aim upon the aircraft. In order to increase the value of the photographs, it would be well to determine the height of the machine above the fortifications and hence the scale of the pictures. The height above sea level could readily be determined by means of a barometer, but it would not necessarily show the height above the fortifications. However, with a searchlight throwing a conical beam of fixed angle, the spot of light upon a film taken with a camera of known focus, would give an approximate index, from which the height of the machine above the fortifications would be determined. By this means it would be possible to make an accurate survey of the fortifications with a minimum exposure of the aeronauts.

Another method of discovering the height of the aeroplane above the fortifications, the artist suggests, is to have two searchlights placed at opposite ends of the machine and mounted to move together in such a way that their beams would intersect always at a fixed distance below the aeroplane. The height of the aeroplane above the fortifications would then be shown by the size of the intensely illuminated spot produced by the overlapping portions of the beams of light.



MAKING NIGHT PHOTOGRAPHS FROM AN AEROPLANE

The Recent Gliding Experiments of the Wrights

By Grover Cleveland Loening

A GREAT and widespread interest has been aroused by the experiments now being conducted by Orville Wright at the scene of the first great flights by man, Kitty Hawk, N. C. Many reports have been circulated with regard to the real purpose of these experiments, some of them no doubt exaggerated and perhaps amusing to the taciturn Dayton inventors. Orville Wright's "vacation" is nevertheless an occasion upon which the eyes of the aviation world have good cause to look sharply. Other than to teach Ogilvie how to glide, and to test a "tail" glider, Orville Wright is evidently bent upon continuing in a logical manner the exhaustive experiments in free flight conducted over so many years by his brother and himself.

The most startling achievements that have resulted from this latest series of tests are briefly as follows: In a biplane glider similar in many respects to the model B Wright machine frame, but differing in the smaller size of the planes and the use of a larger rudder, and sitting upright with the usual control mechanism in his hands, the aviator has succeeded in making glides that far exceed anything done in this line before. He has attained greater heights, greater distances, and stayed aloft a longer time. The general character of the glides, however, bears much resemblance to the 1903 experiments. On Monday, October 23rd, a curious accident took place. Rising some twenty feet from the side of the hill, the heavy rear rudder appeared to become uncontrollable and to make the glider so "tail heavy" that it began to turn over and start backward, whereupon Mr. Wright climbed to an upright position of safety on the overturning machine with such excellent judgment that when the apparatus struck the ground and smashed Mr. Wright emerged unhurt. This experience suggests that many of the fatal accidents in aviation were avoidable by the same *sang froid*.

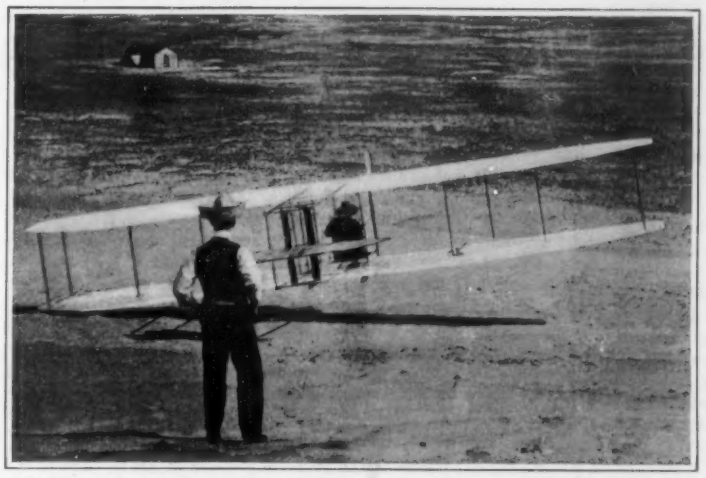
Of course the lighter loading would make the time of fall in such an emergency, longer as well as render the shock lighter.

On the next day, October 24th, a feat that has long been predicted and looked forward to was accomplished. With consummate skill Orville Wright soared aloft into the teeth of a supposedly fifty-mile gale, and succeeded in not only soaring for a period of almost ten minutes but in actually advancing into the wind. This great flight was made over the side of the hill facing the wind so that the air currents must have had a decidedly upward trend. The distance covered by the flight was a quarter of a mile and the height attained estimated at 200 feet above the surface. Though the results are astonishing to many, those familiar with the nature of air currents expect even more startling performances at an altitude three or four times as great.

It is hardly possible as reported that the object of these tests was to try out a device for automatic stability. There is not yet enough known of wind cur-

rents and their motions to enable a thoroughly successful device of the sort to be even conceived. It may be definitely assumed that the purpose of Orville Wright's experiments are primarily to learn more of wind conditions. Many problems such as the avoiding of "side-slipping" still remain to be solved. Not until every possible vagary of the air currents becomes known, can a device for automatic stability be designed and be successful.

It is due partly to the peculiar phenomenon often called "Lilienthal's Tangential," that a glider with cambered planes can not only remain stationary but in a wind of great enough upward trend can be made to actually advance without the exertion of any motive power whatsoever. This would appear offhand like perpetual motion, but it must be borne in mind that the huge energy of the rising current itself is the source of power. The phenomenon referred to is merely, that at certain angles, the total air pressure acting on a plane ceases to act in a line normal to the plane or its chord, and instead the line of action of this force takes a position well in front of the normal, the pressure thus materially acting in the dual role of a supporting *and propelling* force.



Orville Wright starting from the top of a sand dune with his new glider.

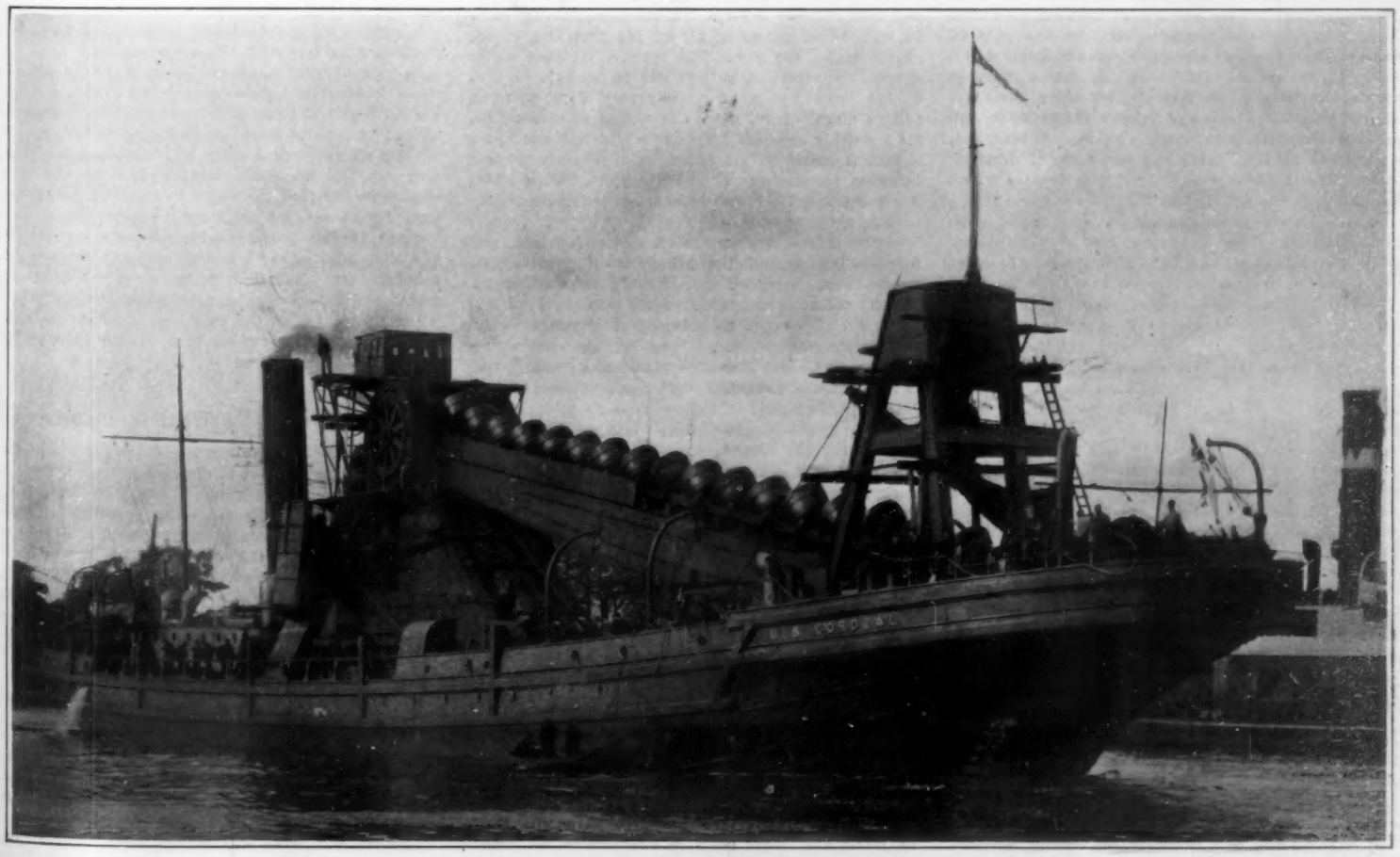
Octave Chanute, early in 1909, pointed out in a masterly way the manner in which this problem of soaring could be solved and many experts since then who have investigated the problem are convinced that it is a feasible one, even though it appears to defy physics. These experiments of the Wrights are therefore likely to bear fruitful results—results that may eventually become of the utmost importance. It will be interesting to note what changes in their standard design the Wrights will make as a result of these tests.

The British-built Dredger for Panama

Hopper Capacity 1,200 Tons of Dredging, Bucket Ladder will Reach to Depth of 50 Feet.

By Our English Correspondent

ONE of the vessels around which an acute political—we can scarcely call it economic—controversy has raged in America for some time is the "Corozal," an extremely powerful bucket dredger which has been built by Messrs. Wm. Simons & Company (Limited), of Renfrew, Scotland, to the order of the United States Government, for carrying out some of the most arduous underwater cutting to be done in connection with the Panama Canal. The vessel has a hopper capacity of 1,200 tons of dredgings and the bucket-ladder is designed for dredging up to a depth of 50 feet. It is propelled at a speed of 10 knots per hour by two sets of triple-expansion, surface-condensing engines, supplied with steam from two cylindrical, multitubular boilers, constructed to Lloyd's requirements for a working pressure of 180 pounds per square inch. A complete outfit of the most modern auxiliary machinery is provided in the engine room, including independent air pumps, circulating pumps, feed pumps, feed heater and filter, etc. The dredging gear is of the most massive description and is arranged to give three speeds of buckets to suit the various kinds of material to be dealt with. The dredging gear can be driven by either of the main propelling engines. Two sets of buckets are provided, one of 54 cubic feet capacity for dredging soft material and one of 35 cubic feet capacity for dredging stiff clay. The bucket ladder is a steel girder of exceptional strength and an idea of the great strength of the bucket chain may be conveyed by the statement that the ladder with its chain of buckets, links and pins, weighs upward of 240 tons. The upper end of the bucket ladder is supported on an independent pivot shaft and the lower end is controlled by powerful steel wire-rope tackle and independent steam hoist gear, which is designed for raising the latter at a speed of 10 feet per minute. Steam maneuvering winches are fitted at bow and stern, each driven by independent, two-cylinder engines, and each barrel is fitted with friction clutch and brake, to enable the mooring chains to work independently of each other, or simultaneously, as may be required. Shoots are provided for loading into the vessel's own hopper, also overboard shoots controlled by independent steam winches, for loading into barges alongside. The hopper doors are controlled by independent hydraulic gear. This dredger, "Corozal," was launched on the Clyde in September and she is to undergo severe tests before being despatched on her voyage round South America to the western end of the canal. Before leaving British waters, she will be tested, first in lifting sand and mud from the bottom of the Gareloch, off Helensburgh, and, afterward, she will be taken back to Renfrew where the buckets will be changed, and subsequently she will be sent to Belfast and tested in the hard clay of the Musgrave Channel. The dredger was constructed to Lloyd's full requirements and Mr. T. M. Post and Mr. A. V. B. Candler have superintended the construction of the dredger on behalf of the United States Government for the Panama service.



THE BRITISH-BUILT DREDGER FOR PANAMA

Abstracts from Current Periodicals

Phases of Science as Other Editors See Them

Why is the Flesh of the Watermelon Red?

IN a recent number of the *Rundschau*, Prof. O. N. Witt makes some very interesting reflections on the colors of living objects of nature. We reproduce here in abridged form some of the essential points:

Modern science teaches us that everything in nature has its definite purpose. The naïve point of view of past ages, according to which a well meaning Providence has adorned the world about us in order to minister to our pleasure, has had to give way to the inquisitive gaze of modern scientific investigation. We now know that the refreshing green of the woods and meadows is not provided for our enjoyment, but for the serious and practical purpose of plant nutrition; the flowers display their bright colors to attract the insect that carries the pollen from stamen to sigma; the Alpine hare is snow colored so as to be hidden from the sight of his enemy, while the lion is tawny and the tiger striped, in order that he may be undistinguishable from the natural background as he lies in wait for his prey. All these facts are plain enough and we admire the perfection of these adaptations, and this feeling of intelligent appreciation we now feel to be of greater worth than the ignorant worship of yore. True it is that Darwin's brilliant hypothesis of the "survival of the fittest" does not satisfactorily explain just how the different organisms set about acquiring the various characteristics and colors which are now so useful to them. Here and there an instance may be found where the process of adaptation is explicable enough, but there are many cases which baffle the ingenuity of biologists of to-day. What is still more unintelligible, and has apparently never been explained, is that nature is often lavish in dispensing brilliant colors where, in the natural course of events, they seemingly can never be of any account whatever. The number of instances of this kind are innumerable; just a few may be picked out for illustration here. Why, for instance, is the blood of all warm blooded, and of many cold blooded, animals, red? It is not intended, under normal circumstances, to be visible, its principal function being fulfilled in the lungs, hidden away from sight. Attention has been drawn to the remarkable analogy between the red blood pigment and the green pigment of plant leaves, but whatever may be the chemical analogy, there is no analogy whatever in the functions, for the color of chlorophyl is plainly connected with its function in absorbing light for the purpose of building up starch from atmospheric carbon dioxide. In the case of hemoglobin there is no such analogous function whatever. Furthermore, it is known that there must be colorless substances capable of performing the functions of the blood, for many animals of the lower type actually have colorless blood. Again, we may ask, why is the flesh of many animals colored? For instance, why is the salmon colored with the hue which has taken its name from this fish? No one can tell.

Exactly similar conditions are met with in the vegetable kingdom. Why is the red beet deeply colored, while its close congeners have a white juice? After all, neither, under normal circumstances, see the light of day, so that it is problematical what useful function the color can possibly serve. Then again, why does the madder root contain quantities of alizarine and allied dye stuffs that in the past have been of such great value, while in modern times we have learned to manufacture them by artificial means? Of what possible use can such dye stuffs be to the plants? Consider the watermelon, covered by a thick, opaque, dark green skin. We may make some sort of conjecture as to the purpose of this; it perhaps serves in keeping off some of the large animals which would devour the fruit, skin and all, and thus leaving the melon to be burrowed by worms, who leave the seeds untouched. But why that appetizing pink color of the flesh of the melon? It cannot serve as a charm to attract visitors, for the guest that has eaten its way through the skin needs no further attraction, after he has reached the interior. The black color of the seeds may perhaps be put down as a preventive measure, protecting them from sharing the fate of the rest of the fruit.

The attractive and appetizing outward appearance of most fruits is generally explained by supposing that its function is to attract animals, which eat the fleshy portion and carry the seed away from the parent plant, thus aiding the distribution of the species. The red cheeks of a peach are so enticing that this explanation will probably be readily accepted. But why that brilliant red color where the flesh meets the kernel? The bird that picks at the flesh of the fruit does not strike this colored layer until the work is practically accomplished.

Certain trees which furnish the so-called dye woods deposit pigment by the hundredweight within their stems. The woad or indigo plant and several others contain a substance known as indican, which is normally colorless but is transformed by a fermentation and oxidation process into deep blue indigo. This case is particularly puzzling, since the color of the dye stuff is not even developed in the living plant.

Perhaps no science is more replete with problems for the future to solve than biology and physiology.

The Toughness of the Chinese Physique

IN a recent number of the *Popular Science Monthly*, Prof. E. A. Ross discusses some peculiar characteristics of the Chinese race in its resistance to disease. That there must be a marked difference in the character of this race as compared with ours is obvious enough, when we consider that out of ten children born among us, three, normally the weakest three, will fail to grow up; out of ten children born in China about eight are doomed to die in infancy. The difference is due to the hardships that infant life meets with among the Chinese, and it need hardly be pointed out that with such rigorous selection there will necessarily result a stock displaying a peculiar hardihood. Just what kind of a hardihood depends on the particular conditions of selection, as Prof. Ross brings out clearly in his article. To anticipate his conclusion, the fact is that while the Chinese resist certain diseases with remarkable power, other diseases are more fatal to them than to us. Prof. Ross collected his data by questioning a number of physicians who had practiced for a number of years in China. One or two among these gave an opinion differing from the others, but by far the great majority agreed in their verdict.

Where the constitution of the Chinaman excels is in his extraordinary power to resist septic infection. Some of the instances cited to illustrate this fact are almost incredible and are too gruesome to invite repetition. Amazing, also, is their response to the treatment of neglected wounds.

A boy whose severed fingers had been hastily stuck on any how and bound up with dirty rags came to the hospital after a week with a horrible hand and showing clear symptoms of lockjaw. They washed his hand and sent him home to die. In three days he was about without a sign of lockjaw. A man whose fingers had been crushed under a cart some days before came in with blood poisoning all up his arm and in the glands under the arm. The trouble vanished under simple treatment. A patient will be brought in with a high fever from a wound of several days' standing full of maggots; yet after the wound is cleaned the fever quickly subsides. A woman who had undergone a serious operation for cancer of the breast suffered infection and had a fever of 106 degrees, during which her husband fed her with hard water chestnuts. Nevertheless, she recovered.

Living in the super-saturated, man-stifled land, profoundly ignorant of the principles of hygiene, the masses have developed an immunity to noxious microbes which excites the wonder and envy of the foreigner. They are not affected by a mosquito bite that will raise a large lump on the lately-come foreigner. They can use contaminated water from canals without incurring dysentery. There is very little typhoid, and what there is, is so attenuated it was long doubted to be typhoid. All physicians agree that among the Chinese smallpox is a mild disease. The chief of the army medical staff points out that during the autumn maneuvers the soldiers sleep on damp ground with a little straw under them without any ill effects. Coolies, after two hours of burden-bearing at a dog trot, will shovel themselves full of hot rice with scarcely any mastication, and hurry on for another two hours. A white man would have writhed with indigestion. The Chinese seem able to sleep in any position. I have seen them sleeping on piles of bricks, or stones, or poles, with a block or a brick for a pillow and with the hot sun shining full into the face. They stand a cramped position longer than we can and can keep on longer at monotonous toil unrelieved by change or break.

But there is another side to the comparison. There is little pneumonia among the Chinese but they stand it no better than we do, some say not so well. There is much malarial fever and it goes hard with them. In Hong Kong they seem to succumb to the plague more readily than the foreigners. Among children there is heavy mortality from measles and scarlet fever. In withstanding tuberculosis they have no advantage over us. While they make wonderful recoveries from high fevers they are not enduring of long fevers. Some think this is because the flame of their vitality has been turned low by unsanitary living. They have a horror of fresh air and shut it out of the sleeping apartment, even on a warm night. In the mission schools, if the teachers insist on open windows in the dormitory, the pupils stifle under the covers lest the evil spirits flying about at night should get at them. The Chinese grant that hygiene may be all very well for these weakly foreigners, but see no use in it for themselves.

From the testimony it is safe to conclude that at least a part of the observed toughness of the Chinese is attributable to a special race vitality which they have acquired in the course of a longer and severer elimination of the less fit than our North-European ancestors ever experienced in their civilized state. Such selection has tended to foster not so much bodily strength or energy as recuperative power, resistance to infection and tolerance of unwholesome conditions of living. For many centuries the people of south and central China, crowded together in their villages or walled cities, have used water from contaminated canals or from the drainings of the rice fields, eaten of the scavenging pig or of vegetables stimulated by the contents of the cess-pool, huddled under low roofs, on dirt floors, in filthy lanes, and slept in fetid dens and stifling cubicles. Myriads succumb to the poisons generated by overcrowding and hardly a quarter of those born live to transmit their immunity to their children. The surviving fittest has been the type able to withstand foul air, stench, fatigue toxin, dampness, bad food and noxious germs. I have no doubt that if an American population of equal size lived in Amoy or Soochow as the Chinese there live, a quarter would be dead by the end of the first summer. But the toughening takes place to the detriment of bodily growth and strength.

To the west the toughness of the Chinese physique may have a sinister military significance. Nobody fears lest in a stand-up fight Chinese troops could whip an equal number of well-conditioned white troops. But few battles are fought by men fresh from tent and mess. In the course of a prolonged campaign involving irregular provisioning, bad drinking water, lying out, loss of sleep, exhausting marches, exposure, excitement and anxiety, it may be that the white soldiers would be worn down worse than the yellow soldiers. In that case the hardier men with less of the martial spirit might in the closing grapple beat the better fighters with the less endurance.

In view of what has been shown the competition of white laborers and yellow is not so simple a test of human worth as some may imagine. Under good conditions the white man can best the yellow man in turning off work. But under bad conditions the yellow man can best the white man, because he can better endure spoiled food, poor clothing, foul air, noise, heat, dirt, discomfort and microbes. Reilly's endeavor to exclude Ah San from his labor market is not the case of a man dreading to pit himself on equal terms against a better man. Indeed, it is not quite so simple and selfish and narrow-minded as all that. It is a case of a man fitted to get the most out of good conditions refusing to yield his place to a weaker man able to withstand bad conditions.

A Revival in the Whaling Industry

IT is reported in the *London Financial Times* that a Tyne firm is about to dispatch a fleet of five vessels—three whalers, a factory ship, and an oil carrier—to engage in whaling in the vicinity of Kerguelen Island, where Norwegian stations are already established. From many parts of the world comes the news of an active revival in the whaling industry, which had been at a low ebb for many years. Norwegian companies are said to be reaping enormous dividends in southwest African waters, and a German company, just formed with a capital of $250,000, is about to begin operations in the same region.

About twenty Norwegian expeditions, with crews aggregating 700 men, are in the field. The Norwegian companies, as a rule, buy second-hand British steamers, and fit them out with all the most modern appliances for whale catching and trying out. The whole process of recovering the marketable products from the carcass is carried on at sea.

Upward of a dozen whalers hail from Dundee. One of these, the "Balæna," has recently declared a dividend of 34½ per cent.

Engineering

Quick Work on Panama Locks.—Over sixty-seven per cent of the concrete for all the locks of the Panama Canal is in place. At Gatun 81.5 per cent of the concrete has been laid; at Pedro Miguel over 87 per cent; while the two twin locks at Mira Flores have about one-third of the concrete in place.

Tunnel and Terminus at Montreal.—A subsidiary company of the Canadian Northern Railway has completed plans for effecting an entrance into the heart of the city of Montreal by building a three-mile tunnel under Mount Royal. A new terminal will also be constructed, in which the latest improvements in terminal facilities will be embodied. The total cost of the tunnel and terminal together will be $25,000,000.

September Progress on the Panama Canal.—The total amount of excavation on the Panama Canal for September was 2,538,764 cubic yards, as compared with 2,687,088 cubic yards in September, 1910, and 2,836,365 cubic yards in September, 1909. The grand total of canal excavation to October 1st was 150,723,962 cubic yards. There yet remains to be excavated 44,599,417 cubic yards, which is less than one-fourth the entire excavation for the completed canal.

Evidence of a Mine Beneath the "Maine."—According to a dispatch from Washington, the former chief constructor of the navy, Rear-Admiral Washington L. Capps, who recently inspected the operations in uncovering the "Maine," will confirm the report of the Naval Court of Inquiry of 1898, which stated that the condition of the wreckage led to the conclusion that the primary explosion took place beneath the hull of the "Maine" in the neighborhood of Frame No. 18.

Cape Cod Canal Open in 1913.—In a recent address before the Atlantic Deep Waterways Convention in Richmond, Commodore J. W. Miller stated that the Cape Cod Canal will be open in 1913. This important work will enable shipping to avoid the stormy passage around Cape Cod and to pass from Buzzards Bay into Cape Cod Bay by a short connection of eight miles. The channel will be 30 feet deep at high water, which is more than the depth of the Manchester and the Kiel canals.

The Lathe as a Chip Producer.—Mr. Joseph Chilton, in a paper read before the North East Coast Institution of Engineers and Shipbuilders, states that as a chip producer, the lathe is the most economical of machine tools. He finds that a well-designed lathe, under favorable conditions, produces half a pound of chips per horse-power per minute when cutting mild steel, the pressure on the tool being approximately 100 tons per square inch "area of cut"—this last meaning the depth of cut multiplied by the feed; a cut half inch deep with a one-eighth-inch feed having an area of one-sixteenth of a square inch.

Great Steaming Radius of British Submarines.—The most notable fact in the development of submarines is their increase in size and in steaming radius. This means that the submarine is approaching the day when it will accompany the fleet on the high seas, and play a most important part in the general action of the future. The British are building two new classes of submarines, one of 600 tons, and the other of 800 to 1,000 tons displacement. Sixty-six of their latest submarines have a surface radius of 2,000 miles, which is being raised to 4,000 and 5,000 miles in what is known as the new "B" and "E" classes.

Deep Submersion of Submarines.—The submarine "Salmon" has established a record for deep diving, which exceeds anything that has been hitherto accomplished in our own navy. It will be remembered that during the early summer months, the "Octopus" attained a depth of 125 feet. This has been exceeded by 19 feet by the "Salmon," which was submerged to a depth of 144 feet off Prudence Island, and remained at that depth for 20 minutes. The submarine is certainly coming into its own, as will be shown in an article by Lieut. Bingham, Commander of the Third Submarine Division, which will be published in our Naval Number of December 9th, 1911.

German Naval Activity.—A recent government paper issued in Great Britain, giving the total naval expenditures for the last ten years proves how keen is the competition in naval construction among the great powers of the world. In 1901 Great Britain expended $50,000,000 on new construction, and in 1911 the amount is $85,000,000. Germany, which in 1901 spent $23,000,000, in 1911 is spending $58,000,000 on new construction. The United States spent $26,000,000 in 1905 on new construction, and she is spending about the same amount this year. The outlay for new construction in France was about the same in both years as that of the United States. The most significant feature of this comparison is the fact that in the decade under consideration, German expenditures for new construction have nearly trebled.

Science

The Stettin-Berlin Water Route.—The new canal connecting Berlin with the River Oder (and hence with Stettin, the nearest seaport to Berlin) will, it is expected, be completed by the autumn of 1912. It will accommodate vessels up to 660 tons. Undoubtedly the commercial importance of Stettin will be much enhanced at the expense of Hamburg by this new and short water route from Berlin to the sea.

Postponement of Scientific Congresses.—Owing to the disturbed state of public affairs in Italy, several international scientific meetings that were to have been held in Rome this autumn have been postponed. According to information received by the State Department in Washington, the International Congress of Tuberculosis and the International Congress of Archæology are now expected to be held next April. The International Geographical Congress has also been postponed until next spring, but the date appears not to have been settled.

The Geophysical Journal.—Under this title the British Meteorological Office is about to add to its long list of valuable periodical publications a monthly section of the British Meteorological Year Book, which will include daily data for meteorology, terrestrial magnetism, atmospheric electricity, etc., based upon observations at the Meteorological Office observatories and anemograph stations. An annual supplement will also be published, giving hourly values. This departure is in line with the advanced policy of providing material for synoptic studies in meteorology and related sciences for the benefit of students of dynamic rather than static problems.

Canadian Asbestos.—About 82 per cent of the world's supply of asbestos comes from Canada, according to an account of this industry published in the *Chamber of Commerce Journal*. The Canadian output has increased from 380 tons in 1880 to 63,300 tons in 1909. The quarries and factories are capitalized to the amount of $24,290,000. In the Black Lake quarries, Province of Quebec, there are 45,000,000 tons of asbestos in sight. The asbestos slate or shingle industry, a development of the last five years, has grown to such an extent that it is predicted that within a short time 75 per cent of all the asbestos produced in Canada will be used in making this new roofing material.

The Jesuit Seismological Service.—In the absence of a government seismological service in the United States, it is fortunate that a number of Jesuit observatories have organized a service, which includes stations at the following points: Buffalo, N. Y.; Cleveland, O.; St. Louis, Mo., New Orleans, La.; Spring Hill, Ala.; Denver, Colo.; St. Boniface, Manitoba; Santa Clara, Cal.; Spokane, Wash.; Brooklyn, N. Y.; Worcester, Mass.; Fordham, N. Y.; Chicago, Ill.; Milwaukee, Wis.; St. Mary's, Kan. The first nine of these are in full action, sending in regular reports to the central station, St. Ignatius College Observatory, Cleveland; whence they are transmitted to the international seismological headquarters at Strassburg, Germany.

Ozone and Ball Lightning.—W. M. Thornton, writing on "thunder-bolts" in the *Philosophical Magazine*, applies this term to ball lightning—though authority for such an application is not to be found in the dictionaries. The disappearance of one of these mysterious balls is said to be always followed by a strong smell of ozone. The writer believes that the principal, though perhaps not the only constituent of a ball of lightning is an aggregation of ozone and partially dissociated oxygen, thrown off from a negatively-charged cloud by an electric surge after a heavy lightning discharge. The explosion in which the phenomenon so often terminates is explained as due to the energy liberated on the transition of ozone to oxygen.

Powdered Milk for Polar Expeditions.—The announcement that two tons of powdered milk have been ordered for the use of Dr. Mawson's forthcoming antarctic expedition has helped to bring into prominence an industry which is assuming large proportions in Australasia, especially in New Zealand. The same product was used extensively by Shackleton's expedition, and was the principal food of Prof. David's party, which reached the south magnetic pole. New Zealand powdered milk is a serious rival to condensed milk, on account of its nutritive value and especially its keeping qualities. It is said to be much superior to condensed milk for infants' food, as it is thoroughly sterilized, contains no cane or beet sugar, and, in the process of drying the milk, the casein is divided into fine particles, as in human milk. One kind of powdered milk, made entirely from skim milk, is used largely in biscuit factories and in the manufacture of milk chocolate.

Aeronautics

Aeronautics in Italy.—The American consul at Venice reports that the first Italian school for the instruction of aerial pilots has been established and subsidized by the royal government at Pordenone, a town in the province of Udine. Italy's third military airship has been under construction during the past year.

An Aeroplane Service in the Congo.—According to the London *Times* a government subsidy of $80,000 has been voted for the initial steps in the establishment of communication by aeroplanes over regions of the Belgian Congo that are still unprovided with railways and roads. It is proposed to traverse a desert 750 miles across, and to establish landing stations 250 miles apart fitted with wireless telegraphy. Each aeroplane is to carry three passengers and a relatively heavy load of food, water, tools, etc.

Carrying Mail by Aeroplane.—According to the report of the post office inspectors to the Postmaster-General, no less than 43,247 pieces of mail matter were despatched by aeroplane from the Nassau Boulevard Aerodrome between September 23rd and October 1st. So enthusiastic has the Postmaster-General become as to the possibility of saving time and money in delivering mail in certain districts by aeroplanes, that he has asked for an appropriation of $50,000 to enable the Post Office Department to experiment thoroughly along these lines. Just as the automobile is at the present day rapidly replacing the horse in city mail delivery, so the aeroplane will no doubt displace the fast express before many years have passed.

Results of the International Balloon Race.—The international balloon race, which started about a month ago from Kansas City, was won by Hans Gericke, the German aeronaut, who covered 471 miles. Lieut. F. P. Lahm, was second, with 408 miles, and Lieut. Vogt, of Germany, third, with 350 miles. Fourth and fifth places went to John Berry and W. F. Assman, with 293 and 275 miles, respectively, to their credit, while Emile Dubonnet was sixth, with 200 miles. The French aeronaut remained in the air longer than any of his competitors but was blown back 400 miles. He has offered to wager $2,000 that he will beat any American who will come to France and fly against him between now and the first of the year.

Successful Use of Aeroplanes in Actual Warfare.—Cognizant of the excellent showing made by the aeroplanes in reconnaissance in the French and German maneuvers, King Victor Emmanuel sent to Tripoli with the armada, eight monoplanes and two biplanes. After flying over the fleet on October 23rd, Capt. Piazza made a 45-minute flight in a Blériot monoplane about the neighboring country. The Arabs were awe struck when the machine swooped over them, and the theory that an aeroplane can be used for the purpose of creating panic was shown to be a correct one. The flight mentioned extended as far as the Zanzor oasis, some fifteen miles from Tripoli. Valuable information was obtained as to the disposition and numbers of the Turkish infantry.

The Trans-continental Flight.—Aviator Rodgers wrecked his machine in starting on a narrow road at Spofford, Texas, on October 25th. The day before he had covered the 132 miles from San Antonio, Texas, in 5 hours and 22 minutes, including stops of about 2 hours for repairs and the making of exhibition flights. This is the first bad smash he has had since leaving Huntington, Ind., but he remains undaunted and expects to eventually reach the Pacific Coast. Meantime, on October 24th, Robert G. Fowler has made another start in the opposite direction. He arrived at Mecca, Cal., at noon of the 24th ult., after having covered 61 miles in 68 minutes.

A New Hydro-aeroplane Record by Naval Officers.—On October 9th, Lieuts. Ellyson and Towers, of the Navy Aviation Corps, started on a flight from Annapolis to Hampton Roads with a Curtiss hydro-aeroplane. After flying five miles they were obliged to descend on account of motor trouble. Another start was made two days later, and this time the officers covered 65 miles and landed at Smith's Point, Virginia. A motor break-down terminated this second attempt. The third attempt was completely successful and was made on the 25th ult. The officers covered about 140 miles from Annapolis to within two miles of Fortress Monroe in 2 hours and 27 minutes, at the rate of nearly 60 miles an hour. The flight was made entirely above the waters of Chesapeake Bay, and most of the way an elevation of 1,000 feet was maintained. The officers often shifted the control wheel from one to the other, and they were very enthusiastic over the operation of this new device which was brought out a few months ago by Mr. Curtiss and on which he has applied for a patent.

The mast packed for transit.

Wireless Telegraph Set for Cavalry

By the English Correspondent of the Scientific American

How the generator set is carried.

ONE of the recent developments of wireless telegraphy for military purposes is an equipment for cavalry use to insure a positive means of communication between bodies of mounted troops or with the main body and the commander-in-chief's staff.

The installation is completely self-contained, comprising a small and light motor driving a dynamo, a receiving and transmitting set, and a mast. The whole outfit can be handled by a squad of four men and eight horses, four animals being required for the transportation of the parts. One horse carries the generator set, another the transmitting instruments, the third the receiving equipment, and the fourth the detachable mast and the wire stays.

The generator set is particularly interesting. Secured to the saddle is a light outer framework of tube steel, with four side members projecting to serve as legs when the saddle is removed and stood on the ground. Each pair of legs carries a lug and bracket near the ground to form a support on the one side for the small dynamo and on the other for the small gasoline engine. Above each is fitted a semi-cylindrical tank to carry the fuel, oil, etc. It will thus be seen that the weight of the installation is fairly equally divided for the horse. When the saddle and load is removed from the animal's back, it forms a rigid structure on the ground. The dynamo which is air cooled is direct-coupled to the motor by a short length of detachable shafting slipped into sockets on the shafts of the engine and the dynamo respectively.

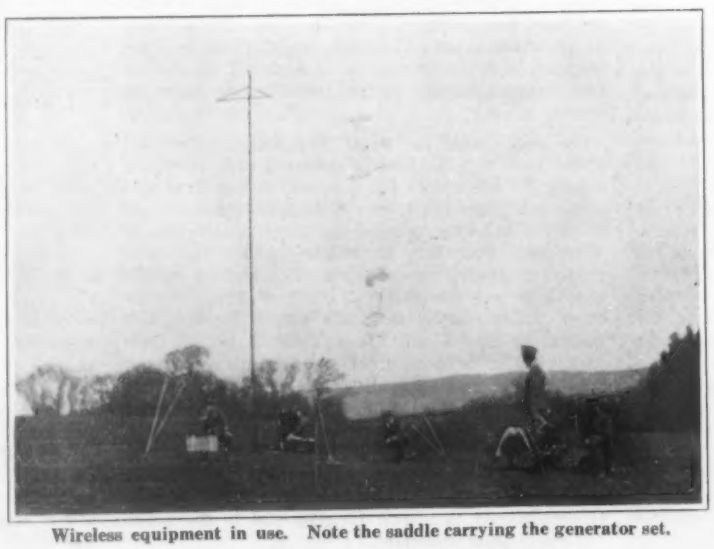
The telegraphic instruments are of the latest Marconi type. Both the receiving and transmitting apparatus may be packed into small compass so as to lie flat against the horses' flanks. The mast is built in lengths of about four feet, which slip together in much the same way as the parts of a fishing rod, and when erected give a mast between 40 and 50 feet in height.

The equipment shown in the illustrations is one of two that have been acquired by the Westmoreland and Cumberland Yeomanry of Great Britain and are identical in every respect with those recently employed in demonstrations in Turkey and in Spain. They were submitted to a searching test on the occasion of the Investiture of the Prince of Wales at Carnarvon, when they accompanied the Westmoreland and Cumberland Yeomanry which had been ordered to attend the ceremony. One of the stations was established in the vicinity of Carnarvon, while the other was set up at the headquarters some distance away. By means of these two installations constant communication was maintained between the two points, which did not possess other communicating facilities beyond a circuitous telegraph line; also with the Royal yacht anchored off Holyhead and with the warships in attendance. Communication was also secured between Carnarvon and Liverpool. Heavy work was thrown upon the field station at Carnarvon as messages had to be received and distributed to all points.

This regiment employs the two outfits regularly on maneuvers. Within a few minutes of halting the company can secure communication with another mounted unit or the main camp, while only a few minutes are required to dismantle the whole equipment and to pack it upon the horses' backs for transport. The British War Office is following this development closely owing to its great military value, and there is every probability that similar sets will be distributed among the regular mounted troops.

The equipment set up in the field.

The wireless cavalry squad with complete equipment.



Wireless equipment in use. Note the saddle carrying the generator set.

A PORTABLE MILITARY WIRELESS PLANT

Neglected Paestum

ONE of the noblest Greek cities of southern Italy was Paestum of the wild roses, and the site is of easy access. A carrozzella will convey you all the way to Pesto from Sorrento or Pompeii, if you dislike railway trains. Pesto itself is of course a malarial wilderness, over which three big Doric temples stand silent guard. Qualified excavators have neglected the site to their shame, because these monuments and a Roman town wall seemed to survive the dead Greek city alone. Pesto is a buffalo pasturage. Piranesi's etchings of the old temples are familiar to print collectors, and one sees them painted and photographed a-plenty in the Naples art shops. If our architects realized how superior they are to the over-extolled Parthenon in their rugged early Greek lines and masses, to say nothing of their glorious gray and orange weathering, they would copy their serried colonnades and their towering gables. Wilkins surveyed them for his "Magna Græcia." Pesto is further the scene of a chapter in Hans Christian Andersen's fairly popular Italian novel "The Improvisatore."

In the face of all this modern notoriety, a German editor has been able to locate the ruins of Paestum or the Greek Poseidonia on the south coast of Sicily, and to credit Spinazzola with the discovery of those early Greek structures in 1911! His firm contention that the extant temples at Pesto originally occupied hilltops like other Greek temples, and that plentiful remains of the antique city lay buried between them, was the Neapolitan archeologist's real merit. Spinazzola has proved his point with pick and hoe. He began his probe at the two principal gates in the Roman wall. Vestiges of the city's older, Greek gates were found under the Roman. The next step was the location of a Greek "Main Street" on the earlier level, along a line connecting the north and south gates. An abundance of wall, gate, road-bed and house ruins, vases, terra cottas, lion head gutter spouts, bronze swords and spear heads, bracelets and brooches has rewarded the excavator's patience.

Spinazzola's venture has incidentally enriched the Naples Museum's gallery of antique sculptures with a beautiful super-heroic statue of a real Roman hero, the elder Drusus. The marble portrays the Augustan prince in a pontifical robe. And above all, the majestic old temples of Neptune and Ceres crown the summits of their original terraced eminences again. The seaboard settlement has recovered its twofold acropolis.

Earth-eating in West Africa

HENRY HUBERT publishes in the *Bulletin du Comité de l'Afrique Française* an interesting account of the practice of geophagy in the French Sudan. Although the practice is common in many parts of the world, this particular case is remarkable for the systematic way in which the dirt is collected, and for the fact that it occurs in a well-cultivated region, where food is abundant. The earth consumed is a clay, which is found intercalated among the grits of the region in beds of various thickness. The deeper layers are preferred, and for this reason the natives dig galleries, which are so crudely constructed that falls of earth frequently occur, sometimes with fatal results. When an unlucky miner is thus buried, no attempt is made to rescue him, as it is believed that the divinities of the mines require an annual victim. It is stated that individuals not infrequently consume seven and a half pounds of clay daily.

The Peking-Kalgan Railway

The First Railway Financed, Engineered and Built Solely by Chinese

By F. C. Coleman

IT is a fortunate circumstance for the Chinese in their contention for the full supervision of the expenditures of all railway loans from foreign syndicates, that the Imperial Peking-Kalgan Railway, which up to this time stands as the most difficult venture of its kind yet attempted in China, should have been financed, engineered and built solely by Chinese. Of even greater importance in support of this contention is the fact that this road has set a record for low cost of construction which, all things considered, has seldom been equalled. The Peking-Kalgan Railway runs from the capital of the Empire to the chief city on the caravan route to Russia. It is now 130 miles long and is being extended. It was built from the surplus earnings of the government-owned Imperial railways of North China, and from the first rough survey to the driving of the last spike no foreigner had anything to do with its construction. To-day its operation is entirely in the hands of the Chinese. That it was built in spite of natural obstacles to construction which foreign experts declared were absolutely prohibitive to any Chinese engineer and possibly even to themselves, is a personal triumph of no mean magnitude for the chief engineer, Jeme Tien Yow. That it was built at a cost almost without parallel for similar construction—at a lower figure per mile even than some of the foreign-built roads on the level floor of the Yangtse Valley—is a striking object lesson for Europe and America, and will be a powerful weapon for the Chinese in their contention for fairer terms in borrowing foreign money. The line is now operating at a profit, so the directors of the Imperial Railways of North China have succeeded, not only in providing their government with a line that is strategically valuable, but with one that earns a return on the money invested. From first to last, the Peking-Kalgan line is a great triumph for the Chinese.

The name of Jeme Tien Yow stands out above all others in the record of the Peking-Kalgan Railway, and his achievements in connection with that enterprise alone are sufficient to have won him the undisputed title of China's leading engineer. He was one of a number of Chinese students who were sent to America about 1880 to receive university educations. Jeme Tien Yow was the only one who undertook a course in engineering. He graduated from Yale in 1883, and then went to a technical school in England for several years. On his return home he went into the employment of the Imperial Railways of North China, where, working under the British manager of that line, Mr. C. W. Kinder, he rose, post by post, outstripping many foreigners who were senior to him in point of service. Later he was appointed chief engineer of the Peking-Kalgan line.

Preliminary surveys were made for this line in the summer of 1905 and construction work was begun in October of the same year. At the end of nine months the first section of the line, 32 miles long and reaching to the mouth of the Nankow Pass, was completed. Chinese were employed in every department, from the lowest coolie or camel-driver up to the chief himself. The saving of the salaries of high-priced foreign officials, interpreters and various middle men became apparent at once. An even greater saving was found in procuring earthwork and similar constructive materials directly from petty contractors along the line, instead of giving the contract to big contractors and then paying all the commissions necessary in their system of subletting and re-subletting contracts. This practice is not confined to China, but is carried to greater lengths there than anywhere else, and its abuse has been responsible for the great expense of so much work done by foreign syndicates in that country. For earthwork on this first division of the Kalgan line the average cost was about two cents per cubic yard; while after the Nankow Pass was reached and the embankments had to be made out of broken boulders, the cost rose to three cents a cubic yard. Broken stone for concrete was purchased for from 13 to 33 cents a cubic yard, delivered ready for use, and sand for the same purpose averaged about three cents. Most of this section of the line runs over a flat plain, gradually sloping to the mountains.

The Peking station is at Liutsin, a short distance outside the great wall of the capital, as very few Chinese railways penetrate the walls of any of the old cities, both on account of the lack of space inside and because of the violent prejudices of the conservative element of the people against such desecration. For some distance the line runs through a fertile farming country dotted with small villages. The most striking feature of this part of the journey is Waushoushan, the £10,000,000 summer palace of the old Empress Dowager, with its roofs of Imperial yellow tiles standing out strikingly against the green hillside upon which it stands. Shortly the country commences to show traces of erosive wash from the mountains, and before long the crossing of numerous cuts and "arroyos" of gravel and boulders begin. The bridges are all solidly built of steel and concrete, and the largest of them is nearly 300 feet long, having five 30-foot spans and one of 110 feet. The steel superstructure of this bridge—with the exception of the long span which was supplied from England—as well as of all the other bridges on the line, was built in the shops of a Chinese company at Shanhaikuan. The Liutsin section of the line has a total of 21 bridges and 17 drains, aggregating 1,352 linear feet of openings.

At Nankow are quarters for employees, machine shops, locomotive sheds and numerous other railway buildings of excellent construction. There is an up-to-date foundry in connection with the machine shop, where castings of any size required in locomotive and car repairing can be made. A well-equipped hotel, built and managed by the railway, fills a long-felt want of tourists. The Nankow Pass section, the most difficult piece of railway engineering in China, was the next portion of the line to be built. This pass must have presented a very discouraging aspect to the Chinese engineer when, with the honor of his country at stake and with the "inevitable" failure, prophesied by all the foreign engineers in the East staring him in the face, he started over it for his tentative study. There is a rise of 1,800 feet in the 10 miles from the mouth of the pass to the summit at Pataling, and the gorge is so narrow that it seemed almost impossible in places to keep the necessary curvature without tearing down the mountain. Five distinct surveys were run, and on the earlier ones some of the curves were sharp enough to "break the back of a snake," as Mr. Jeme Tien Yow stated it. Slowly, and with infinite pains, a practicable route was determined upon, and along this the present line has been built. Even the most exhaustive surveying, however, could not solve all the problems, and at a point not far from the summit tunnel, where it was necessary to have a station and sidings, a zig-zag was introduced. However, a station being necessary, the inconvenience of the zig-zag was minimized.

The general direction of the railway up the pass is about parallel to that of the old stone-paved highway which leads down to Peking from the plains of Mongolia, the road over which all the Tartar invasions of the Chinese Empire have come since the time of Ghengis Khan. The general aspect of the country, in its rockiness and lack of heavy vegetation, is strongly suggestive of some of the lower reaches of the more northerly passes of the Chilean Andes in South America. The railway up the pass is one continuous succession of cuttings, embankments, and tunnels. The embankments, regardless of their height, are for miles faced with cut and fitted granite blocks. All the overhanging boulders have been removed, or securely cemented into place even for hundreds of yards up the mountain sides, while the solid rock of the cuttings is trimmed as smoothly and evenly as if lined with plaster. The 19 bridges and the 36 culverts are all steel, concrete or cut stone, and in many instances where swift mountain torrents are crossed, cemented beds for the water prevent undermining.

The tunnels of this division are four in number, their respective lengths, in order as approached from below, being 1,200 feet, 150 feet, 450 feet and 3,570 feet. The first tunnel which was driven through limestone, was completed in about six months. The other three tunnels, all of which are in granite, were completed in good time. The one at the summit, the longest in China, took over a year. The summit tunnel, which runs under the Great Wall, was driven according to thoroughly up-to-date practice. A shaft was sunk near the half-way point, and with the aid of fans, drilling machines and modern hoisting apparatus, work was carried on in both directions from the center, as well as from the ends of the tunnel. This shaft, with another, which was sunk to admit air near the northern portal of the tunnel, have since been lined with stone and retained as permanent ventilators. All the tunnels are lined throughout with concrete, which is also used for the portals. The open cutting in the pass, half of which is in solid rock, amounted to 640,000 cubic yards, while the embankments required an aggregate of 1,275,000 cubic yards of material. The latter, except such as was provided from the cuttings, was obtained cheaply by blasting it out of the mountains close by. This earthwork labor cost only £44,000.

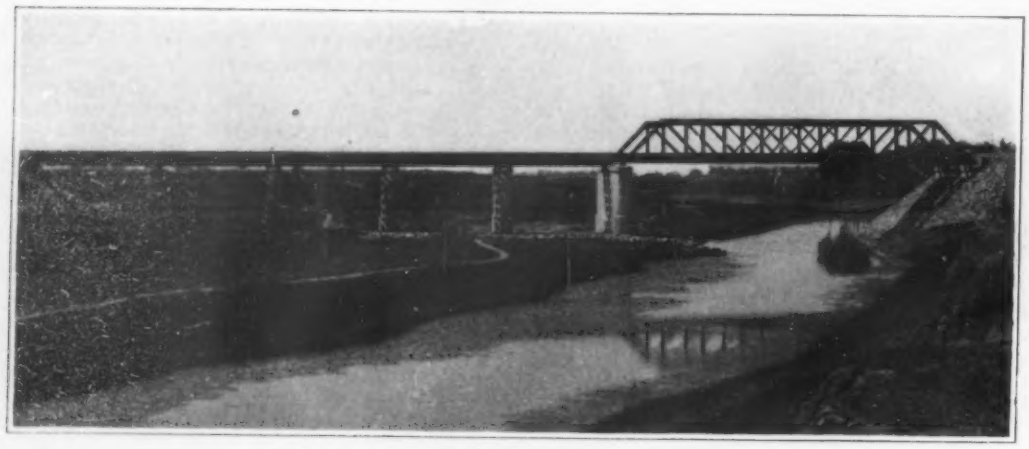
The third or Chatao-Kimingyh division, 38 miles long, was of comparatively easy construction. There are 17 bridges and 32 drains—in all 2,662 feet of linear openings. The principal engineering feature is a 1,000 foot bridge having ten 100-foot spans at Huilahsun. The fourth or Kimingyh-Kalgan division is also 38 miles long, and in engineering difficulties rivals that of Nankow Pass. At Hsiangshupo 16,500 feet of granite and sandstone have been cut through to make a way for the line along the steep bank of the Yangho, the cutting varying from 10 feet to 85 feet deep. There are 2,075 linear feet of openings, 21 bridges and 130 drains. The coal in use is from a mine worked by the railway company near Hsiahua, and the present output of 400 tons per day is ample for the railway requirements. There is a branch line 16 miles in length leading from Hsichihmen to the Mentoukou coal-fields, which gives the product of these mines an outlet to the Peking market.

Of the character of the roadbed of this thoroughly-built line the photographs give a very good idea. (See pages 401, 410, and 411.) The sleepers are mainly of Japanese hard wood of a class which would cost in the vicinity of a dollar in the United States, but which are laid down in China for less than half that figure. On the mountain divisions, creosoted sleepers are used, with safeguards to prevent rail creeping. For the main line, which is of standard gage, 85-pound rails are used; for sidings and branches, 60-pound rails.

The locomotives for the mountain divisions of the line are mostly "Mallet" articulated compound, as shown in two of the photographs, and they were built by the North British Locomotive Company (Limited) of Glasgow. Such of the passenger cars as have not come from the shops of the Imperial Railways of North China at Tongshan are of American manufacture, but the company will doubtless build all its own cars in future. The China-made cars are of a modified British type, a sort of a compromise between a side-door compartment car and one of the center aisle-type. The freight cars are of 30-ton capacity, and were mostly built by the Leeds Forge Co. (Limited).

The Chinese Students' Journal makes this strong plea for Chinese control of expenditures in railway construction: "A railway line is not a clubhouse or a private mansion upon which the owner or owners may expend millions merely for the gratification of their sense of beauty or for an exhibition of their wealth, but it is a commercial investment. The amount of capital invested in it must be commensurate with its power of paying dividends, and in the case of Chinese railways the redemption of the bonds must not be for a moment forgotten. Economy on the Peking-Kalgan railway has been reduced almost to a science. There is no temptation to spend money recklessly, as no five per cent commission on every tael spent can enrich the coffers of any corporation. There are no engineers who must have foreign style residences, cement tennis courts, ice-making machines, palatial house-boats and princely salaries before beginning work. There are no interpreters to browbeat the contractors, to make trouble with the local officials, and to make a fortune in little or no time. All contractors deal with the engineers directly, and no graft exists. The figures for the price of materials explain in a large part why a railway built under our own supervision and by our own engineers is so very much more economical. Another very important advantage gained is the peaceful condition of the coolies during construction, due to the absence of misunderstanding between engineers, the coolies and the country people. No disturbance of any kind, still less of any rioting, has ever happened, and the work has proceeded so smoothly and quietly that the local officials are never called on to suppress disorders or punish offenders. There can be no unpleasantness arising through the interfering of foreign consuls and the referring of insignificant incidents to the ministers in Peking. One and all understand that the railway is a Chinese railway, that our own money is being spent, that the coolies are our own people, though they are coolies, that the officials are officials appointed by the Emperor, and the result is that the work proceeds without a hitch of any kind."

An example of heavy cut-and-fill work.



A typical bridge over one of the smaller streams.

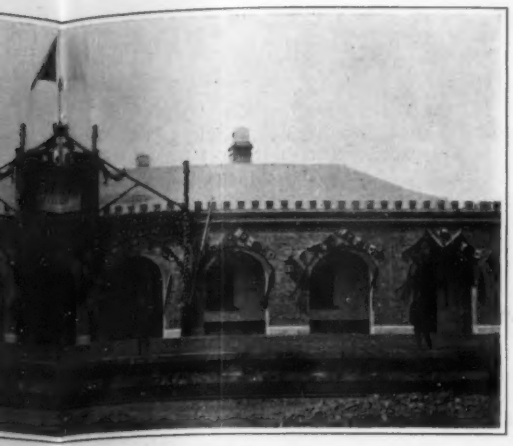
Kalgan Station, the northern term

Engineers who built the railroad; Jeme Tien Yow,

A short tunnel. Note the peculiar railroad signal posts.

A typical oriental scene at one of the stream

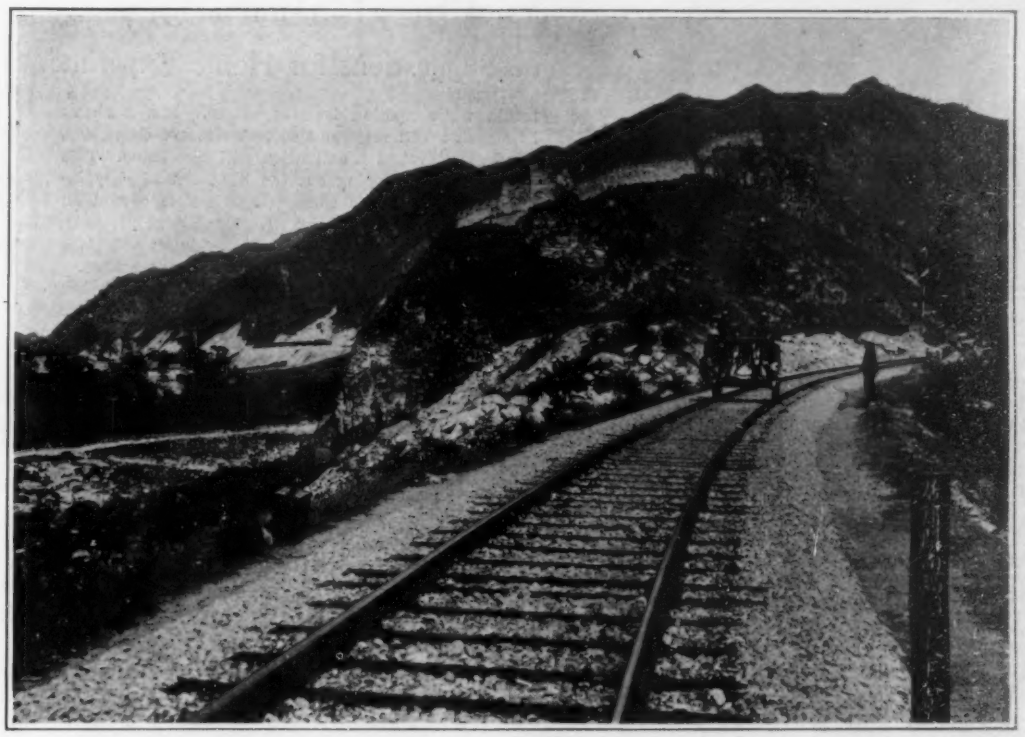
THE PEKING-KALGAN RAILWAY—THE FIRST RAILWAY FINANCED



northern terminus of the railroad.

Jeme Tien Yow, the chief engineer, in the center.

one of the streams along the line.



The hand-car looks incongruous under the shadow of the great wall.

One of the longer bridges. The piers are built of concrete.

Curious mixture of old and new: tunnel, culvert and great wall.

AY FINANCED, ENGINEERED AND BUILT SOLELY BY CHINESE

The Laboratory

Some Suggestions for Home Experiment

Microscopic Photography

By Norman Borden

IT is the purpose of this article to give a definite idea of how photomicrographs are made and at the same time to give the possessor of a microscope precise and accurate directions for obtaining photographs of microscopic objects.

The entire apparatus consists of a microscope and accessories, camera shutter and body, rack for carrying the camera and if necessary a source of artificial light. Fig. 1 shows most of the pieces of apparatus which are to be considered separately in the following paragraphs:

First, the quality of the objectives must be taken into consideration. A chromatic objective is entirely out of the question for making high amplifications. An achromatic objective, free from scratches, must be used in securing high power negatives. Objectives of 3, 4, and 16 millimeters focal lengths will be found to suffice for amplifications up to 1,000 diameters. Also if the eyepiece is to be used in connection with the objective, both lenses must be perfectly clean. One method of cleaning lenses is to wash them in a solution of tincture of green soap and distilled water, using absorbent cotton, and, then, as a final, to rinse them in pure grain alcohol.

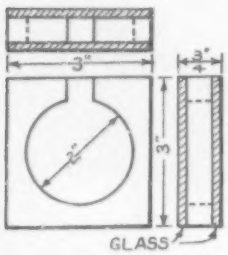


Fig. 2.—Cell for ammonio-suiphate solution.

Fig. 3.—Epithelial cell with bacteria.

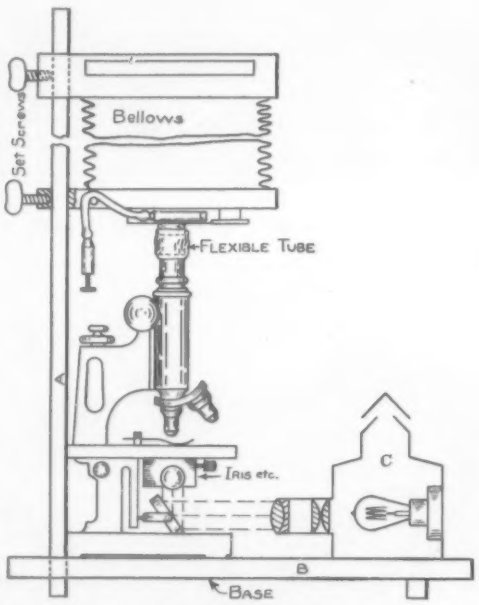


Fig. 1.—General arrangement of the microscope and camera.

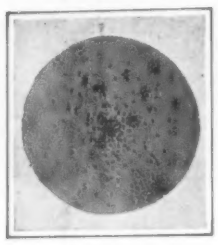


Fig. 4.—Micrococci cultured on potato.

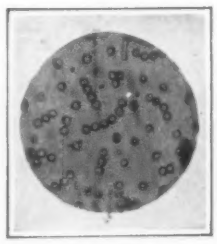


Fig. 5.—Fungus spores, 500 diameters.

One form of a frame work for carrying the camera is shown in Fig. 1. The base *B* is large enough to accommodate a stereopticon or other source of light. The uprights *A*, of which there are two, should be made of metal rods or tubes. They must be fastened rigidly to the base and if necessary, strongly braced. It is of great importance to have the apparatus as rigid as possible so that it will not vibrate. Four feet is a suitable length for the uprights. In constructing the camera and bellows, the main object is to get them light tight. For the bellows rubberized cloth will be sufficient. The plate holder is made to slide upon the uprights and is provided with thumb set-screws so that it may be fastened at any position. If a regular camera shutter is not at hand the exposing can be done by using a cardboard before the mirror of the microscope.

Perfectly white light gives the best results. Sun light may be used if the photographer is provided with a heliostat. The student had better resort to an artificial light such as gas or electric light. The tungsten light is the best of the convenient incandescent lamps. If this lamp be used as shown in Fig. 1, its light will be found sufficient for all magnifications up to 1,000 diameters. If the gas mantle is used, the stereopticon should be provided with a number of light trapped ventilators. Mono-chromatic light can also be used to advantage with certain objects. This kind of light is obtained by the use of ray filters which absorb all the light except the color wanted. A substitute for true mono-chromatic light is the light which passes through a cell containing ammonio-sulphate solution. This last named light is also free from heat waves, so that there is no danger of softening the mounting media while making long exposures. Fig. 2 shows how such a cell may be made. There are times, too, when dark ground illumination will be wanted. This is effected by stopping out the light immediately behind the object with some opaque substance put on the front lens of the condenser. When done properly, a cone of oblique rays illuminates the object and gives it more relief so that it has a natural appearance.

The appearance of the object in the negative has to do with the plate used. Isochromatic plates give truer color values than the ordinary plates. Fast plates can be used to an advantage over the slower ones.

Working Directions.

We will begin by picking out an object that is suited for photography, namely, a diatom "Triceratium Favus," which is generally the first one of prepared diatom plates. The diatom is placed in the center of the field and then the microscope is put in connection with the camera by means of a small rubberized tube. The magnification will be about 200 diameters, so the camera is fastened in its position and a rough focus is made. The finer details cannot be seen on the ordinary ground glass, so a focusing glass is used and a piece of plain glass is substituted for the ground glass. In this last named method of focusing, the aerial image is used to focus upon and it must be in the same plane that the sensitive surface of the plate will be. The light is adjusted while focusing, by means of the iris diaphragm.

Rules for exposing cannot be given in precise statements. With a heliostat, 5 millimeters objective and 400 diameters amplification, the exposure would have to be about 2 or 3 seconds. Using light from the clear blue sky, an exposure of 30 to 90 seconds would be made for an amplification of 50 to 75 diameters. The time of exposure depends upon the light used, the color of the object, the plates used and the magnification. The one aim in making photomicrographs is to produce a dense negative with contrast.

Developing and Fixing.

As there are a great number of reliable developers on the market it is not advisable for the beginner to mix his own. Develop the plate until the details show from the back of the plate and then rinse in plenty of water and transfer to the fixing bath. Here it should remain long enough to clear the last traces of silver. The negative is then washed and intensified if necessary. To intensify, immerse the plate in a saturated solution of mercury bichloride until it is bleached white and wash thoroughly. Next immerse in a solution of ammonium hydroxide (about 10 per cent) until the film turns black again. This method produces intensification to a moderate degree.

Preparation of Specimens.

Epithelial cells are good objects for practising mounting and staining. They are found in a free condition in the saliva, the microscopic constituents of which are (*a*) the salivary corpuscles, which are about the size of the white corpuscles of the blood (8 to 10μ); (*b*) the pavement epithelial cells; (*c*) living organisms from the cavities of the teeth; (*d*) leptrothrix buccalis, which are large rod-shaped bacteria. All these objects are well suited for photography when deeply stained with fuchine and mounted in balsam. Fig. 3 shows an epithelial cell with bacteria.

In Fig. 4 is seen a group of micrococci, which were cultured on a slice of potato. They are easily stained mythel-violet and mounted in Canada balsam. The spores of the fungus, Asperguillus Glaucus, magnified 500 diameters are seen in Fig. 5. Fungus spores do not need be stained and are best photographed dry. Among other objects are pollen grains, sections of plant stems and plant hairs. The stagnant water in frog ponds contains innumerable specimens.

A Heat-storing Water Bag

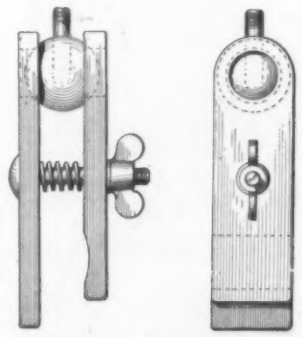
THE bag described in the following paragraphs is a great improvement over the ordinary hot water bag. Besides its property of retaining heat longer, it can be prepared so that it will store heat, be set aside and then used at a future time. It is then ready for any emergency. Fill an ordinary hot water bag with either sodium sulphate crystals or hypo crystals. The crystals cost about ten cents per pound at the drug store. Sodium sulphate is preferable. To use, place the bag, which should be tightly corked, into a vessel of boiling water, and boil for about fifteen minutes. The crystals in the bag are now in a liquid state, i. e., a super-saturated solution has been formed. The bag is now ready for immediate use. It will now impart its heat steadily about four times as long as the same weight of water. If the bag becomes cold in too short a time, it is a sign that it has been boiled too long.

To prepare the bag for future use, boil twice as long as you did for immediate use. You can if you wish, use the bag while it is giving off its temporary heat in cooling, and then later utilize its latent heat. The storing qualities of the bag depend upon the heat of crystallization. The solution in the bag has become super-saturated by long boiling of the bag. Upon cooling it remains a liquid, but if it is touched by the cold fingers or suddenly jarred, or if one of its crystals is inserted in the solution, the whole mass crystallizes, and the heat of crystallization is given off. Sometimes the solution on solidifying forms in one hard lump. This does no particular harm, but it may be prevented by kneading the bag at intervals while in use.

Ball Clamp for Holding a Camera

By J. H. Bentley

A BALL clamp for holding a camera to any suitable support may be made very simply as follows: Two clamp plates should be fashioned out of a 1¼-inch by 5/16-inch stick of wood, one being 4¾ inches long and the other 4¼ inches. A ¾-inch hole is drilled at one end and countersunk on the inside, the other end of the short one being cut away as shown to give the clamp a good grip on angles. Very often a wooden ball can be found on the end of broom handles or a discarded child's ten-pin set, knobs, etc. The stud in the ball is ¼-inch-24 thread, for standard cameras, and is pressed tight into a hole drilled for it.



A camera-supporting clamp.

The cup-head bolt is also ¼-inch-24 and the inside of the head should be filed a very obtuse V as shown to prevent turning and to form a rocking fulcrum when on an angle. The spring on it keeps the clamps apart.

The Inventor's Department

Simple Patent Law; Patent Office News; Inventions New and Interesting

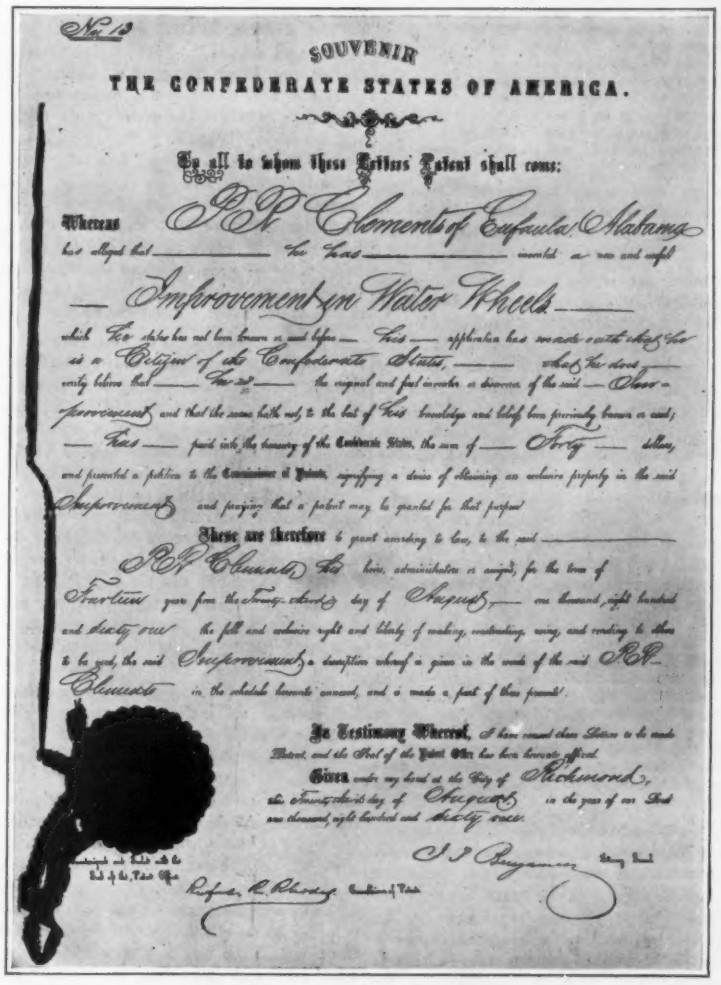
A Confederate Patent Discovered

ON the 23rd day of August, 1861, the Confederate States of America granted Letters Patent, No. 13, to P. R. Clements of Eufaula, Ala., covering an improvement in water wheels. The original of this patent, which is in the possession of a Washington patent attorney, is the only one known to the United States Patent Office to be at present in existence. Its whereabouts was discovered by Mr. James T. Allen, a first assistant examiner in the office, and one of the oldest employees in point of service, now in that bureau. Mr. Allen entered the Patent Office in September, 1868, several years after the Confederate States of America ceased to exist, but he has always been interested in the collection of statistics and information regarding the work of American inventors.

Mr. Allen obtained the loan of Confederate Patent, No. 13, and at his own expense had a plate made, from which the reproduction on this page is taken. There are several interesting features about this patent. It will be noticed that the term of the patent is fourteen years, whereas at that time United States patents were granted for a term of seventeen years, the period having been extended from fourteen to seventeen years by the Act of March 13th, 1861, nearly six months prior to the date of the Clements Confederate patent. The fee is fixed at forty dollars, which is very reasonable, considering the fact that the present fee for a United States patent is thirty-five dollars. Confederate money is not specified in the grant, but it is to be presumed that that currency was the proper legal tender in the Confederate Patent Office. The grant bears the signatures of I. P. Benjamin, the first Confederate Attorney General, and of Rufus R. Rhodes, Confederate Commissioner of Patents.

There is room for conjecture in the serial number of the patent; data as to the previously granted patents, a round dozen in number, are not available. The patentees under these may long ago have faded into dust; the inventions may be as worthless as the grant under which they were issued. Whether or not thirteen was the sum total of patents issued by the Confederate States is not known. Perhaps in the possession of some old family of the South are the original records of the long-forgotten Patent Office of the Confederacy. These alone can answer the question. Perhaps, carefully guarded as priceless mementoes of the past, are scattered here and there throughout the land of Dixie the yellowing documents granting exclusive rights to inventions long since forgotten or superceded.

The pages of history are always being reopened in this way. Looking down the long vista of years, one can see the struggling states south of the Mason and Dixon line, who believed in the right as they saw it, and sacrificed their all to support their convictions. When P. R. Clements of Eufaula, Ala., was handed Letters Patent, No. 13, of the Confederate States of America, the paper was clean and crackling and the signatures on it were scarcely dry. High hopes bounded in his bosom as he realized that for fourteen years he would have protection in which to enjoy the fruits of his toil. Even now his improved water wheels may be turning in some hamlet of the Southland, grinding the meal that is to form the daily bread of its citizens—citizens of the Confederacy no more, but citizens of the United States, the nation that has recently issued its millionth patent. But the holder of that millionth patent, which has been so widely advertised and so lauded as being typical of the great achievements of the American brain, was not more proud of his possession than P. R. Clements of Eufaula, Ala., when he was granted No. 13, of the Confederacy.



No. 13

SOUVENIR

THE CONFEDERATE STATES OF AMERICA.

To all to whom these Letters Patent shall come:

Whereas P. P. Clements of Eufaula Alabama has alleged that he has invented a new and useful Improvement in Water Wheels which he alleges has not been known or used before; and has made oath that he is a Citizen of the Confederate States, and that he does verily believe that he is the original and first inventor or discoverer of the said Improvement; and that the same hath not, to the best of his knowledge and belief been previously known or used; and has paid into the treasury of the Confederate States the sum of Forty dollars, and presented a petition to the Commissioner of Patents, signifying a desire of obtaining an exclusive property in the said Improvement, and praying that a patent may be granted for that purpose:

These are therefore to grant according to law, to the said P. P. Clements his heirs, administrators or assigns, for the term of Fourteen years from the twenty-third day of August one thousand, eight hundred and sixty-one, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said Improvement, a description whereof is given in the words of the said P. P. Clements in the schedule hereunto annexed, and is made a part of these presents.

In Testimony Whereof, I have caused these Letters to be made Patent, and the Seal of the Patent Office to be hereunto affixed.

Given under my hand at the City of Richmond, this twenty-third day of August in the year of our Lord one thousand, eight hundred and sixty-one.

J. P. Benjamin Secy. of State

Rufus R. Rhodes Commissioner of Patents

Confederate States Letters Patent No. 13.

Women Patentees in One Issue

AS showing the activity of the ladies along inventive lines, it may be noted that among the patents issued October 10th, 1911, are found many to women inventors. These include Ada Litton of Revere, Mass., who patents, No. 1,005,244, a ribbon renovating device; Evalena O. Leggett of Niagara Falls, N. Y., whose patent, No. 1,005,240, is for an insulating compound; patent No. 1,005,213, to Hattie D. Hinds of Rutland, Vt., for a jar wrench; the fireless cooker, patent No. 1,005,211, to Ada T. Hill of Salem, Ill.; the electrically heated tray, patent No. 1,005,166, to Florence L. Crombie of Detroit, Mich.; patent No. 1,005,124, to Effie A. Babst of Crestline, Ohio, for a sectional railroad rail; patent No. 1,005,542, to Ada Harmer of St. Louis, Mo., for a stand and gage for dress makers; patent No. 1,005,575, to Estelle C. Raney and Charles E. Simmons of Steubenville, Ohio, for an automatic circuit breaker for electrical distribution systems; Mary E. Van Luven, Oakland, Cal., No. 1,005,675, for an irrigating vessel; No. 1,005,752, to Jennie R. Sherrod of San Francisco, Cal., for a hook for hooks and eyes.

Patents That Expire This Year

AMONG the many patents for important or representative inventions which have or will expire during the year 1911 may be mentioned the patent to Smethurst, No. 520,902, June 5th, 1894, for potato harvester; the seed drill patent, to Schopp & Liese, No. 513,060, January 16th, 1894; patents to Pitt, No. 516,745, March 20th, 1894, and to Stevens & Swart, No. 519,460, May 8th, 1894, for transplanters; the patent, No. 524,629, to Popp, August 14th, 1894, for preserving; the cigar making machine of Moonelis, No. 514,238, February 6th, 1894; patent No. 522,132, June 26th, 1894, to Van Ruymbeke, for distilling glycerine; patent No. 528,322, to Castner, October 30th, 1894, and to Craney, No. 520,257, May 22nd, 1894, for the electrolytic production of caustic soda, sodium carbonate and chlorin; the patent to Coyle, No. 518,394, April 17th, 1894, for sewer construction; No. 522,782, to Clouser, for a railway switch which can be operated without leaving the car; patents No. 520,812 and No. 520,813, June 5th, 1894, to Thomas, for pneumatically controlled switches and signals; patent to Morgan, No. 517,619, April 3rd, 1894, for a passenger elevator with automatic mail collecting and delivering devices; Sellers, No. 520,940, June 5th, 1894, for armature winding; patents to Scott, June 5th, 1894, No. 521,051, and to Hunting, February 20th, 1894, for electric motive power; Fiske, No. 529,484, November 20th, 1894, for printing telegraph; the Copeland patent, No. 529,110, November 13th, 1894, for bicycle crank shaft fastening, dispensing with the connecting keys. Greater strength as against telescoping or crushing in collisions and other accidents is sought by a rolled steel plate construction in a patent, No. 512,960, of January 16th, 1894, to Jewett. Miller's patent, No. 516,084, March 6th, 1894, for cable transportation; patents No. 516,053, March 6th, 1894, to Hulett, and No. 527,117, No. 527,118 and No. 527,119, to Lay, October 9th, 1894, for coaling steamers; No. 518,895, of April 24th, 1894, to Porter, for handling hay, and No. 515,296, of February 20th, 1894, No. 526,839, of October 2nd, 1894, and No. 530,232, of December 4th, 1894, to Louden, for means for unloading hay; the Burgess patent, No. 520,752, of May 29th, 1894, for automatic fire arms; the hot water car heating patent to Towne, No. 512,239, of January 2nd, 1894; patent to Bickinel, No. 526,361, September 18th, 1894, for a brushing machine; the shoe insole channeling machine, patent to French and Meyer, No. 529,900, of November 27th, 1894; the stitch separating and welt indenting machine, patent of Hadaway No. 521,978, of June 26th, 1894; the patent, No. 528,128, of October 23rd, 1894, to Julian, for sole-rounding machine; patent to Dunbar, No. 521,233, June 12th, 1894, for machine for making screws, bolts, etc. Klatte patent, No. 523,432, July 24th, 1894, for chain making machine; the Coffin patent, No. 512,694, of January 9th, 1894, and the Hunter patent, No. 520,360, May 22nd, 1894, for electrical welding of metal; patent No. 514,705, February 13th, 1894, to Cornell, for label affixing machine; patents to Barry, January 2nd, 1894, No. 511,745, and to Ethridge, No. 521,605, June 19th, 1894, for mail marking machines; the Goodson patent, No. 530,481, December 4th, 1894, for type-setting machine; the Northrop loom, patent No. 529,943, November 27th, 1894, patent No. 517,795, April 3rd, 1894, to Morgan, for machine for dovetailing box blanks; clothes pin making machine, No. 513,572, to Hall, January 30th, 1894, tooth pick machine; No. 521,734 and No. 526,668, to Davis, September 25th, 1894, for rotary machine; the photograph burnisher to Boles, No. 527,315, October 9th, 1894, and magazine camera, No. 522,921, to Spooner, July 10th, 1894; illuminating life preserver to Guest and Bates, No. 512,957, January 16th, 1894; apparatus for oiling waves, Hallett, No. 529,379, November 20th, 1894; marine torpedoes, Holland, No. 522,177, June 26th, 1894, and Baker, No. 530,466, December 4th, 1894; Gorham, No. 525,952, invalid bed.

Inventors' Permanent Exhibit in London

CONSUL-GENERAL JOHN L. GRIFFITHS, in an official communication published by the Bureau of Manufactures, is quoted as saying:

"It is stated that a permanent exhibition will be held in London for the benefit of inventors. The exhibition is to be kept open throughout the entire year, and inventors will be afforded the opportunity of displaying their patents to possible purchasers, not only in the United Kingdom, but from all parts of the world. It is purposed employing expert demonstrators, who will take visitors through the various sections of the exhibition and who will have technical knowledge of the sections with which they are specifically connected.

"Through this exhibition, which has its financial side, it is hoped to bring investors who are anxious for promising patents in which they may place their money, in touch with patentees who may have something of real value to offer but who are unable frequently, under existing conditions, profitably to dispose of their inventions."

Invention Necessary to Patentability

WE are constantly seeing new things that seem ingenious and many times important, but which cannot be protected by patent because they do not possess or

involve the prime essential to patentability —invention. A thing may be new and it may be for a useful purpose, but if it stops there and does not involve invention, it cannot be protected by patent, because patents are the reward for the products of invention. Thus, Walker says: "Patents are grantable for things invented, and not for things otherwise produced." He also announces the absence of any universal affirmative rule for determining whether invention exists, but gives a number of negative rules, thus emphasizing the difficulty of determining what is or is not invention, but in no way affecting the fundamental principle that invention is necessary to patentability, thus dignifying and elevating the patent grant. Many inventors have not the mechanical skill to produce the invention in physical form and it is not necessary that they should have it for if the inventor conceives and supplies all the inventive ideas he can employ mechanical assistants in the production of the actual embodiment of his invention.

Notes for Inventors

A Sensible Night Signal for Automobiles. —Many of the most serious automobile accidents are due to a misunderstanding or ignorance of the driver's intentions, and so a system of hand signaling has come into vogue, which, although crude, answers many purposes so long as the driver of one car is enabled to see that of another. At night such communication between the car operators is impossible. A rear signal has been devised for the purpose. It is electrically operated and consists of three lamps and a horn. A red lamp is lit permanently, while above is a green lamp, which, being flashed, signifies that the driver is about to stop. To the right and left are white lamps, signifying his intention to turn to the right or left. These signals are all electric and are operated by buttons, conveniently placed for operation by the chauffeur. As any one of these signals is made, the horn is sounded to attract the attention of anyone who may be following.

An Illuminated Life Preserver.—An illuminated life saver has been on trial for some time in the German navy and so highly is it regarded that it is likely to be adopted for use on the warships. It consists of two long floating cushions, which are secured on the chest and back, passing over the shoulders, and which are strapped in place somewhat after the fashion of a knapsack. This shape is said to support the body in the water much more comfortably than the life preservers of older form. This apparatus is equipped with an electrical lamp, supplied with current from a battery, and the lamp is automatically thrown into action upon the buckling of the belt around the person. This feature is regarded as of great value in some kinds of accident, especially those at night, and in times of peace, although in warfare it would not always be desirable.

Street-car Letter Boxes.—It was objected to early letter boxes for use on street cars for the collection of mail matter, that where the openings were of sufficient size to permit the deposit of mail conveniently, they also permitted the entrance of rain, which generally had a serious effect, causing the envelopes to become unsealed and addresses effaced or at least rendered illegible. The postal authorities are conducting some experiments at Washington with a street car equipped with a letter collecting box which is proof against the entrance of rain. The box has a large opening with sloping sides, which facilitate the passage of mail matter without regard to size or number of pieces deposited. The sides of the opening are supplied with a double arrangement of gutters which catch all raindrops and carry the water away from the mail matter in the box.

The Humors of Patent Specifications.—The ideas of different people as to the usefulness of a device necessary to support a patent are sometimes very amusing. A patent was once granted for a cube-shaped device, intended for use by card players, as a tally block, and in the original specification, the inventor, either from a sense of humor or from a misunderstanding of what was required in applications for patent, described some remarkable utilities for the device. Thus he writes:

"Besides the above mentioned conveniences to a card player, I claim it to become a constant companion to present humanity and countless millions to come. The man of business will carry it in his coat pocket and rejoice to be in a position to meet any emergency. A hole in his pocket does not bother him as he can carry his loose change in the tally block. The sponge can be changed at will containing the perfume that shall permeate his clothes, walking about on the street his nose is apt to offer a good landing place for soot, the little mirror on tally block keeps him from rubbing at it x-eyed and spitting on his handkerchief, the sponge will perform that duty. No fear of foot pads as a corner of the tally block on the top of his head with a gentle pressure will make quite an impression. Coming home baby cutting teeth and is cross will change into a smiling miracle when papa pulls out the tally block and juggles with the dice box, its attention being riveted the pain is all gone. Coming late from a lodge meeting and the key being about one inch out of his reach on the transom, the tally block is as good as a step ladder. In case wifey thinks she has heard a noise in the cellar or wants him to look at the gas meter, the tally block answers the purpose of a candle holder. To a poet with inspirations or those who wish to keep record of a dream and write in the dark, nothing takes the place of the tally block"

and so on for many paragraphs of the same kind of matter, which, needless to say, were eliminated before the actual issue of the patent.

There are Cops and "Cops."—The examining corps of the Patent Office is of an unusually high order of intelligence and the members are generally acquainted with the various arts. Sometimes amusing things occur when an examiner fails to understand a technical term well known in another art. A "cop" is defined as "the conical roll of thread formed on the spindle of a spinning machine." In an application, now issued, and consequently a public record, the applicant referred to an illustration as "the representation of a cop." Not understanding the word, the examiner wrote, seriously, a letter in part as follows:

"The attention of the examiner being called to this case, he regards it as in no condition for official judgment on the merits. Applicant shows a device which the examiner would be inclined to regard as the representation of a ball of twine. Applicant says however it is 'the representation of a cop.' It does not look like a policeman, which to the examiner's mind is the popular signification of the word cop, and consequently the word requires some limitations."

The Inventive Convict.—That all people, even hard-hearted jailers, are interested in inventors and inventions is shown by the following story: Some years ago a Washington patent attorney was called on by a man from the West who had an improvement in some refrigerating apparatus and prepared and filed the application for patent, the inventor leaving ostensibly for home. A few days later the attorney received a telegram from the sheriff of the inventor's home county, asking whether he was in Washington, and replied that he had been but had left for home, and later received from the sheriff an explanatory letter to the effect that the inventor had been committed to jail for some offense and while in the sheriff's custody had developed the invention in which the sheriff had taken an interest; that he had, on his own responsibility, released the prisoner temporarily, so he could go to Washington to secure the patent and then return to serve the balance of his term. So far as known, the sheriff is still waiting his return.

Sectional Book Cases.—An early instance of a construction capable of being utilized in a sectional book-case is shown in the expired patent to Spruce, No. 224,486, patented February 10th, 1880. While specified as a post-office box, the patentee described each box as a complete and independent structure in itself, so that in arranging a number of boxes together, this single complete structure enables the placing of them in series vertically and horizontally, according to the space required to be filled, and that the boxes may be made and held in stock, from which orders may be at once filled for a number of boxes, without regard to the space to be filled by the boxes.

A Japanese Appreciation.—A government publication tells how the Japanese government, in proceeding to establish a patent system under their patent act of March 1st, 1899, sent, as a special commissioner, Mr. Korekiyo Takahashi, to the United States to examine into our patent system. At that time, Mr. Perry B. Pierce, now deceased, was examiner of designs, and Mr. Takahashi had many interviews with him. In one of these, Mr. Pierce asked the Japanese commissioner why the people of Japan desired a patent system, and Mr. Takahashi replied: "You know it is only since Commodore Perry, in 1854, opened the ports of Japan to foreign commerce that the Japanese have been trying to become a great nation, like other nations of the earth, and we have looked about us to see what nations are the greatest, so that we could be like them; and we said: 'There is the United States, not much more than a hundred years old, and America was discovered by Columbus, yet four hundred years ago;' and we said: 'What is it that makes the United States such a great nation?' And we investigated and we found it was patents, and we will have patents." In repeating the interview, Examiner Pierce declared that: "Not in all history is there an instance of such unbiased testimony to the value and worth of the patent system, as practised in the United States."

A Patent Office Rival of Tom Sawyer's. —A story is told of the chief clerk of the United States Patent Office, Mr. William F. Woolard, which is in the class with Mark Twain's famous account of how Tom Sawyer escaped the irksome task of whitewashing a high board fence, by persuading his playmates that such work really was a rare pleasure in which an ordinary boy had no opportunity to indulge. In his boyhood days the chief clerk lived in Fairfield, Ill., and it was his duty on Saturday to cut the wood for household use during the week. The burdensome task was increased by having to carry the wood to the wood-house, fifty yards away. To relieve himself of that burden, young Woolard erected an inclined track and constructed a small flat car, so that no labor was involved in sending the loaded car down or the empty car up the track. Its availability as a gravity railway for pleasure riding was soon discovered, and when the boys of the town began to so use it, while the builder was industriously engaged at the wood-pile, a halt was called. Each boy was required to cut a carload of wood in order to be entitled to a free ride. On Saturdays there was a procession of boys with axes and saws, and the wood-yard looked like a husking bee, with the result that the wood-house was soon filled to overflowing. When this condition was reached, the elder Woolard would not meet the further demand for more cord wood.

Snow Melting Apparatus.—A snow melting apparatus in which the snow in finely separated particles is passed into a melting chamber and heat is applied to the snow particles while finely separated is presented in a patent (No. 1,004,113) to Garry B. Van Wye of New York city.

Milk and Cream Mixing Can.—To prevent most of the cream from passing off with the first milk poured out of the can, Newton Sherman has patented (No. 1,004,-919) a milk can with a cover and with a milk and cream mixing device which is independent of the cover and can be operated from the outside of the can without removing the cover.

Disinfects Book Leaves.—As described in a patent (No. 1,005,036) Thomas H. Hood of Greenville, Miss., disinfects books by spreading or opening the leaves by a current of air and utilizing the same current of air to deliver a disinfecting substance to the leaves.

RECENTLY PATENTED INVENTIONS.

These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Apparel.

HAT.—H. BENSEL, 520 Fifth Avenue, New York, N. Y. This invention is an improvement in women's hats, and has in view a binding at the edge of the brim which will securely connect the inner and outer facings of the hat together and keep the lining and covering, if such should be provided, well stretched out, and give this part of the hat a finished appearance.

Electrical Devices.

INSULATING COMPOUND.—EVALENA O. LEGGETT, 1630 Michigan Avenue, Niagara Falls, N. Y. This compound is more especially adapted to the insulating of electric wires or cables. It will act as a perfect insulator, and will be unaffected by ordinary variations of temperature. It can be applied after the manner of paint, which will dry quickly and will not crack or clip off. It is also a waterproof compound which will not "sweat."

APPARATUS FOR EXPLODING MINE CHARGES.—J. KRANNICHFELDT, (Schulz-Agent) Cologne, Germany. Former intermediate switches were driven by clockwork, so that in exploding all the charges in a mine one is bound to the time of the clockwork. To overcome this drawback and to enable the charges to be exploded at desired intervals—if necessary only after examining each circuit —the intermediate or local switch, according to this invention, is controlled, adjusted or operated by electric means from a distant and therefore safe central station.

ELECTRIC PUSH BUTTON.—J. L. MORRELL, 15 Audubon Avenue, New York, N. Y. This invention provides a resilient rest for the plug employed in push buttons which forms an even support therefor to avoid the rocking of the button when depressed to complete the electric circuit in which it is incorporated; provides contacting members for completing the circuit arranged to avoid the usual carbonizing thereof; extends the supporting base of the resilient member of the button; and reduces the labor of assembling the button.

Of Interest to Farmers.

MACHINE FOR PICKING FEATHERS FROM FOWLS.—C. W. SMITH, care of Swift & Co., Produce Dept., Fort Worth, Texas. An object of the inventor is to provide a machine for picking feathers which will effectively accomplish the operation without injury to skin of the fowl. A further object is to provide a device by means of which the feathers may be removed in a much less time than in the ordinary manual operation.

SWEEP RAKE.—E. B. ROCK, Route No. 3 Studley, Kan. In the present patent the invention has reference to an improvement in rakes of that class which are known as sweep-rakes or drag-rakes and which are provided with long gathering teeth that project in front barker removes bark from logs which are to wheels.

HAY STACKER.—E. B. ROCK, Route No. 3 Studley, Kan. In gathering hay in the field and conveying it to the stack, large wheeled rakes commonly known as sweep-rakes are employed. As the stack grows in height, the difficulty of delivering the hay thereon increases correspondingly, and, to facilitate the operation, portable frames, called hay-stackers, are frequently brought into use. The invention is an improvement in this line.

SCOOP FOR EMPTYING PANS.—R. J. ROSS, care of L. C. Turley, Harbison-Walker Refractories Co., Portsmouth, Ohio. This improvement provides a shovel or plow which is mounted to rotate on a shaft disposed over the pan so that it may be rotated into or out of operative position, a lever being pivoted to the plow and being adapted to engage a ratchet in a sector member for holding the plow in a predetermined position.

Of General Interest.

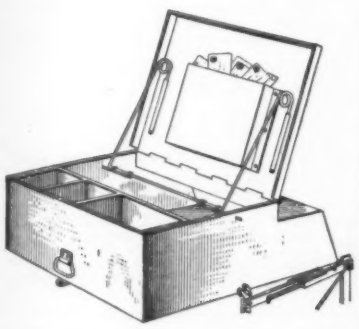
DISPENSING APPARATUS.—L. K. LARRISON, Wharton, N. J. This invention refers to a device whereby a predetermined amount of liquid can be dispensed from a bottle or other receptacle. An object is to provide a receptacle with an internal receptacle or conduit adapted to receive any predetermined amount of liquid from the first-mentioned receptacle, to remove the same from the said receptacle.

COLLAPSIBLE TUBE.—C. H. STUART, Newark, N. Y. In the neck of the tube is a valve by which the discharge of the paste or liquid from the tube is readily controlled, the valve embodying a piston extending crosswise of the neck of the tube and having a discharge passage in its length movable into register with the discharge passage of the neck, the valve having enlargements at each end, one exteriorly arranged and constituting an operating member by which the valve is revolved, and the other preventing the valve from being drawn from the neck.

BANDED BARKER.—I. RICHARDS, care of F. A. LONG, Au Sable Forks, N. Y. This barker removes bark from logs which are to

be made up into paper pulp, and the invention particularly relates to reinforcing means, in the nature of bands for strengthening and lengthening the life of the barker. The barker comprises a plurality of members, spaced apart one from the other and secured to heads with bands encircling the same throughout the majority of the circumference, thereby increasirg the strength, rigidity and durability of the structure.

RURAL LETTER CARRIER'S ALL METAL CABINET.—WILLIAM T. SMITH, Tunnelton, Ind. This invention is an improvement in rural letter carriers' all metal cabinets, and is shown in perspective in open position in the illustration. The mail box is shown as separated into a plurality of compartments by a transverse partition and by partitions at right angles. A rod holds the box in horizontal position and the toggle levers are of such length that they are aligned when the box is in this position. The arms act in the manner and, in fact, are springs to lift the lid or cover. The pocket is designed for letters, while the compartments are for papers and packages. In normal position the box is supported on a dash board and floor of the carrier's wagon. The box is preferably of galvanized material and may be of any desired size.



RURAL LETTER CARRIER'S ALL METAL CABINET

MANUFACTURE OF SCREENS FOR USE IN COLOR PHOTOGRAPHY.—L. DU HAURON and R. DE BERCEGOL, 17 Avenue Pauline, Joinville-le-Font, Seine, France. The object to be obtained is to cover a transparent or translucent surface, such as glass, celluloid, paper, etc., with an extremely large number of exceedingly small regular figures, e. g., bands, rectangles, lozenge-shaped figures, etc., having three distinct colors placed close together without any interval, and each of which theoretically should, altogether, cover a third of the surface.

CLEANER FOR CHALK ERASERS.—J. A. JONES, 321 W. 10th Street, Anderson, Ind. In this instance the invention is an improved apparatus for use in removing chalk dust from black-board erasers, and in practice the inventor employs with it rough and fine pencil-sharpeners which are operated by the same shaft and the same motor as the chalk-eraser.

FOLDING SCAFFOLD.—E. ZAHN, Rhodesia Park, Norwalk, Conn. The invention has reference to folding scaffolds for general use, his more particular purpose being the provision of a simple, strong and efficient scaffold suitable upon the exterior faces of building walls and adapted to be let out and drawn in through windows and the like.

SUCTION APPARATUS.—A. SAUER, care of Sauer Power Generating Company, 5115 Rosetto Street, Pittsburgh, Pa. This invention provides a suction or vacuum apparatus, for heating, ventilating, refrigerating and other purposes. Use is made of a suction chamber provided with an annular passage connected with a steam supply and from which lead a number of spiral passages into the suction chamber to produce a vortex blast in the suction chamber.

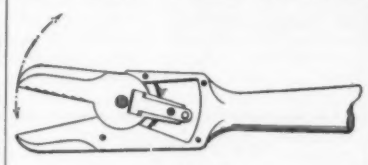
LENS MOUNTING.—G. LOWENSTEIN, 668 Park Place, Brooklyn, N. Y. This invention relates more particularly to mountings, in connection with spectacles and eyeglasses, the special purpose being to produce a device in which the lens is readily detachable from the framework normally supporting it, and yet when held in position by the framework the lens is secured with a proper degree of firmness.

WRITING POSITION AND MOTION TRAINING CARD.—J. L. MONTGOMERY, 259 Rich Avenue, Mount Vernon, N. Y. This improvement provides a card named with openings or stencil forms arranged to control the movement of an inscribing pencil; and to form a paper guide and paper rest to control and facilitate the formation of the marks, the repetition whereof, it is found, trains the hand and arm of the students of chirography.

SAFETY RAZOR.—E. P. MCCOLLOM, 810 North Avenue W., Allegheny, Pa. The improvement is in that type of safety razors in which a reversible blade is secured detachably upon the toothed head or guard, and more particularly in such sub-type as includes a spring handle having the extremities so constructed that they are adapted to enter notches or open slots in the blade, and thus serve as a means for securing the latter.

Hardware and Tools.

WRENCH.—EDWARD L. MARSHALL and GEORGE P. PAVLIK, Ruth, Neb. This improvement in wrenches has for its object the provision of a convenient wrench of the alligator type, comprising a handle, a fixed and a movable jaw, and having means for moving the movable jaw toward and from the fixed jaw, and for locking it, in adjusted position. As shown in the illustration, the cover plate of the wrench is removed. The lower jaw is fixed and the upper movable jaw is provided at its inner end with an enlargement filling the recess. At the center of the recess the jaw is perforated, and counterbored around the opening to secure the hub. The wrench is simple and compact, and the parts are easily assembled.

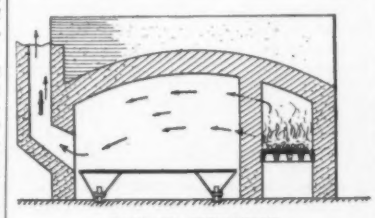


WRENCH

FOLDING BRACE.—F. D. TURNER, Box 84 Woods Cross, Utah, and N. DEF. CORSER, Salt Lake City, Utah. It is well known that one of the most inconvenient tools to pack away is the ordinary carpenter's brace. An object of the invention is to provide a device which is capable of being folded up into a compact form so as to occupy little room in a tool chest or carrier, and which can be easily adjusted to the proper working position.

Heating and Lighting.

GARBAGE CREMATORY.—RALPH E. NYE, Hobart, Okla. In this case the invention is an improvement in furnaces for use in incinerating garbage and has for its object to provide a novel construction in which garbage and the like may be readily moved into the incinerating chamber on a car adapted for the purpose and may be effectively dried and burned. The walls of the apparatus may be of brick or other suitable material. A vertical cross section of the apparatus is shown in the engraving. The apparatus may be used for cremating dead animals and for consuming garbage, excrement, manure and other obnoxious filth requiring intense heat.



GARBAGE CREMATORY

Machines and Mechanical Devices.

MACHINE FOR CONVERTING PULP INTO SHEETS.—H. G. ROGERS, Au Sable Forks, N. Y. This wet machine forms paper or other pulp into sheets, and delivers the same in a partially dry state. It has an increased capacity over machines of the same general type, and in which the sheets are delivered with a relatively small amount of moisture and in uniform lengths and widths and without the use of knives, pins or shears, and without substantial waste of the pulp.

FLYING MACHINE.—C. F. KOHLRUSS, Washington and Ellis Streets, Augusta, Ga. In this machine the weight is in the exact center of the supporting surface, and below the same, thereby greatly increasing the stability and lessening the liability of upsetting by unexpected gusts of wind. In case the motor or motors should stop the planes would permit the machine to settle down gradually to the earth in the manner of a parachute.

MACHINE FOR REMOVING WASTE GILDING.—R. J. COOPER, JR., R. M. SANFORD, and W. BRADY, 10 May Street, New Rochelle, N. Y. The invention refers to a machine for removing the excess gilding material from a cover after lettering or figuring has been impressed thereon, and to scrape off the waste without danger of injuring the covering. It provides a rotary buffing member with a movable table adapted to adjust the work into and out of engagement with the buffer, and with means for adjusting the position of the table.

ESCAPE VALVE.—J. D. BROWER, JR., Pacific Grove, Cal. This invention relates to valves for use in connection with water mains and the like, to permit the escape of gas or air from the main when the water or other fluid is allowed to enter the same, and relates more particularly to a device of this class comprising a main valve adapted to control the escape of gas or air from the main, and an auxiliary valve controlling the main valve, and itself operable by the liquid in the main or conduit.

FLUSHING VALVE.—H. R. GILSON, care of Ambridge Savings Trust Co., Beaver, Pa. In the present patent the purpose of the invention is the provision of a cheap and efficient flushing valve which will operate with any water pressure, and which may be adjusted from without to control the flow of water to meet the requirements, although the water pressure may be greater or less than normal.

VENDING MACHINE.—E. L. ROBINSON, Fire Station No. 2, Topeka, Kan. The object here is to provide a device which upon the insertion of a coin of the proper denomination, will deliver a measured quantity of unshelled nuts into a shelling device and thence into a bag, which has been taken from a pile of the same and held in the proper position by mechanism actuated by the same coin.

BLUE PRINT WASHING AND DRYING MACHINE.—O. HOOPS, 500 Park Avenue, care of Bldg. Bureau, New York, N. Y. The aim in this invention is to provide a machine having two endless belts, having sprocket openings at their sides, which are disposed against each other, and which run over rollers with sprocket teeth journaled in a casing containing tanks and a compartment for respectively washing and drying the blue prints. The last are conveyed between the belts through the machine, and are introduced and removed at points outside the casing where the belts are spaced from each other.

AIRSHIP.—C. V. JOHNSON, Box 1396 Goldfield, Nev. An object of the improvement is to produce an air ship having a construction rendering it easily manageable, having improved means for maintaining its equilibrium, and for directing the course of the air ship. A further object is to provide an arrangement whereby the air ship can float and be propelled in water in case it should alight upon that medium.

MEANS FOR THE PROPULSION OF AUTOMOBILE TORPEDOES.—ALBERT E. JONES, Picard Agent, Fiume, Austria-Hungary. The object here is a means of propulsion specially adapted for obviating numerous defects, at the same time diminishing the friction due to the passage of the shafts through stuffing boxes. This is obtained by arranging the axes of the motor cylinders of the group in planes parallel with the longitudinal axis of the torpedo and below the axis of propulsion, in the direction of running, and also of increasing the stability of the torpedo by lowering its center of gravity. This construction allows of connecting rods and crossheads of normal length. Means provide a hermetic sealing of all the parts.

PUMP.—E. L. HARPER, JR., 522 W. 161st Street, New York, N. Y. Among the principal objects which the present invention has in view are: To provide means for correcting the swirling of the water within the barrel of a pump, and in the delivery column thereof; and to provide in a rotary pump devices for correcting the swirling of the water as and when the same is delivered from the various blades or fins.

SEWING MACHINE ATTACHMENT.—D. WALD, O. C. BRITSCH, and M. TAIGMAN, New York, N. Y. The object here is to provide an attachment for sewing machines, whereby the motor, and controller therefor, will be in an unexposed, unobtrusive position, and whereby either or both the motor and controller can be readily detached for the purpose of renewing or exchanging.

VENDING MACHINE.—C. H. SCOFIELD, Cherry Valley, N. Y. An object of this inventor is to provide a coin-controlled means for automatically delivering an aliquot quantity of peanuts. Further, to provide a means for automatically supplying a bag or other receptacle to the purchaser; and also to provide means for keeping peanuts or other articles stored in the machine, at a suitable warm temperature.

THROTTLING DEVICE FOR MARINE ENGINES.—O. J. MCGOWAN, New York, N. Y. This improvement provides means for shutting off the steam supply of an engine when a seagoing vessel is lifted by the waves to the position commonly called pitching; provides a rocking valve operable by the swing of the hull of the vessel relative to a constant vertical member; and provides a mechanism for throttling the steam supply main of a marine engine.

FLYING MACHINE.—L. C. KINCANNON, Seabright, Cal. This invention is an improvement in machines of the character disclosed in Letters Patent formerly granted to Mr. Kincannon, the machine embodying in its construction a number of rotary carriers each having wings or vanes arranged about its axis and which are intermittently revolved to present the upwardly moving vanes or wings vertically and the downwardly-moving vanes or wings horizontally.

CONCRETE WALL MOLDING DEVICE.—R. W. FULLER, R. F. D. No. 2, Seiling, Okla. An object of this invention is to provide a device comprising movable side members forming parts of a mold, said members being so arranged that they may be securely fastened together when the form is being molded, and can be removed laterally from the wall when it is desired to remove the mold.

AEROPLANE.—R. P. HALL, Searchlight, Nev. This invention provides a machine with lifting capacity to support the weight of its load and a limited amount of freight or number of passengers; provides means for steering the machine vertically and horizontally; provides means for automatically balancing and maintaining the lateral stability; and provides a parachute attachment for landing in the event of damage to propelling means and supporting surface of the machine.

Prime Movers and Their Accessories.

INTERNAL COMBUSTION ENGINE.—T. E. FRIEND, 17 State Street, Norwalk, Ohio. The object of the inventor is to provide an engine having an arrangement of parts such as will secure the maximum horse-power with the minimum consumption of fuel. Further, to secure a perfect mixing of the charge so as to secure the utmost efficiency from the fuel. Further, to prevent the overheating of the engine.

STARTING BURNER.—H. W. GARDNER, care of Farmers' & Mechants' Bank, Springfield, Mo. This invention comprehends a burner of rather simple construction having its various parts suitably arranged, whereby oil in a liquid form and air under pressure are admitted directly into the burner, the air in making its escape serving to atomize the oil and thus form with it a combustible mixture.

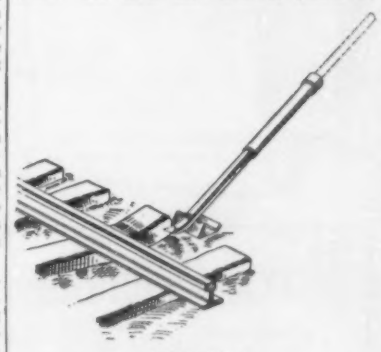
Railways and Their Accessories.

LOCK NUT.—J. G. WOLFE, care of P. S. JENNINGS, 90 West Street, New York, N. Y. For the purpose of preventing accidental unscrewing of the nut, it is made in sections and the opposite faces of the sections are provided with cam surfaces for pressing the sections away from one another against the threads of the bolts to lock the nut in place, at any desired point along the bolt, and means for locking the nut sections together to prevent the same from turning.

CROSS TIE.—W. E. JONES, Chase Mills, N. Y. This invention relates to cross ties for use with railroad track rails and the like, and has reference more particularly to a cross tie which comprises a body, and rail-supporting means at each end thereof mounted to swing into and out of normal positions and having a limited movement longitudinally of the body, this movement serving to raise or lower the rail-supporting elements.

CAR STEP REGISTER.—R. M. BALCH and L. R. BALCH, Neillsville, Wis. This invention comprehends a number of steps provided with depressible platforms, these platforms being too narrow to accommodate more than one person at a time, and electric indicating mechanism connected with the various platforms and controllable by movements of the same for the purpose of counting or indicating the persons depressing the platforms with their feet as the persons move along.

TIE NIPPER.—WILLIAM A. SCOTT, Consul, Ala. This device is represented herewith in a perspective view and placed for operation. In this operation the block forms a fulcrum for the bar, and the latter may be lengthened or shortened to suit conditions. The device is assembled by first passing the eye bolt through the slot, with the transverse pin in place. The block may then be placed between the sides of the plate, and secured by the bolts, after which the bar is engaged with the eye bolt. The flange limits the rocking movement of the block toward the operator. The nipper is adjusted by inserting the small end of an ordinary claw bar in the sleeve, thus giving power to the nipper to hold the tie against the rail while being spiked.



TIE NIPPER

Pertaining to Vehicles.

PERCUSSION MECHANISM FOR AUTOMOBILE TORPEDOES.—A. E. JONES, 2 Via Volosca, Fiume, Austria-Hungary. The object here is the improvement in the percussion mechanism of automobile torpedoes in which the striker is maintained in the cocked position by a lever connected with a releasing member acting by inertia; and it has particularly in view to improve the conditions under which the mechanism operates and the certainty of its operation.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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(12558) R. A. S. says: 1. What is the temperature at which glass and quartz melt? A. Glass gradually softens as it is heated until further heating produces no further change. It does not become a freely flowing fluid at any temperature, but only a thick, viscid substance which flows like cold molasses. Different kinds of glass begin to soften at widely different temperatures. Any glass may be heated probably 400 deg. to 600 deg. F. without becoming soft. Quartz is melted only by the electric arc, which has a temperature above 6,300 deg. F. 2. What is the temperature at which mercury vaporizes? A. Mercury boils at 674.6 deg. F. 3. What is the average amperage per cell of a storage battery when fully charged? A. The number of ampere hours of a battery is usually given by the surface or weight of plates. It differs for different makes of battery and rates of discharge and size of cell. A storage battery in a certain electric light station gave this report: 156 cells, 25 positive and 25 negative plates each, at 10-hour discharge rate gave 278 horse-power per hour, average volts 1.9 per cell, 204 pounds per horse-power hour. At one-hour discharge rate, it gave 1,120 horse-power average volts, 1.8 per cell, 506 pounds per horse-power hour. A rule for lead cells has been given: 53 ounces lead peroxide for a 10-hour discharge rate, increasing to 1 ounce for 1-hour discharge rate. The makers of any particular form of cell will give figures of its performance upon application. 4. What is the formula for finding the wattage of a direct-current generator? A. The volts given by a dynamo are determined by the rate at which the lines of force in the field are cut by the coils of the armature, and the amperes by the resistance of the dynamo as a whole. The watts are the product of the volts and amperes. These quantities are measured by the instruments in the test of a machine. In designing they are assumed, and the machine is built to give its rated output. The sizes of wire to be used are selected to carry the amperes, without heating above the safe limit. 5. Will the color of the tube in a mercury vapor lamp have any effect on the light? What is the best color for ordinary lighting purposes? A. The color of the glass in the mercury vapor lamp will modify the light by absorption. The color to which our eyes are accustomed is that given by the sun, a light containing all the wave lengths from red to violet. 6. In a mercury arc in a vessel the size of a 50-ampere tungsten, what amperage will vaporize enough mercury to break the bulb at 110 volts? A. The pressure of gas or vapor which will break a given bulb varies with the kind and thickness of the glass. No numerical answer can be given to the question as you put it.

(12559) H. C. says: 1. What is meant by the center of the force of gravity, and where is this point situated in the east? It would seem that if the pull of gravity is toward the greater mass; at the center of the earth the pull will be outward in every direction, and consequently the earth hollow. A. The center of the force of gravity upon any body is the point in the body about which the whole body is balanced. In a uniform sphere it is at the center of the sphere. It is what we call the center of the earth. All the matter in the earth gravitates toward that point, all attraction is inward toward that point, not outward from that point. If a ball could be dropped upon the earth and move into and through the material of the earth, it would drop to the center of gravity of the earth. 2. How is it proved that a plumb bob is deflected from plumb by a mass, such as a range of mountains? A. It is proved that a plumb line is drawn out of the vertical by a heavy mass, such as a range of mountains, by means of an engineer's instrument for determining a level line and a vertical line. An engineer's transit is such an instrument, but much more accurate instruments are used by astronomers in solving this very difficult problem. When an accurate vertical line is determined, the deviation of the plumb line was seen and measured. It has been done a sufficient number of times that we may rely upon the results obtained by astronomers.

(12560) C. C. asks: A newspaper recently gave the velocity of electricity, 304,523,160 yards per second, and of light, 328,028,800 yards per second. That has given rise to a good deal of discussion among draftsmen and estimators employed here. You would earn the gratitude of some forty or fifty of the young men interested, if you would state whether or not the velocities given are correct, and if not, what the correct figures are. A. The trouble with the figures which you quote for the velocity of electricity and of light is that electricity cannot be said to have any velocity, and the velocity of light is not known with a limit of exactness of 100 yards per second. The latest determination of the velocity of light by Prof. Michelson of the University of Chicago is 299,860 kilometers per second, with a possible error of 30 kilometers per second. This in miles per second is 186,330, with a possible error of about 20 miles. The velocity of the electric current varies with the conditions under which it flows. Electric waves in wireless telegraphy move with the same velocity as light.

NEW BOOKS, ETC.

ELEMENTS OF THE DIFFERENTIAL AND INTEGRAL CALCULUS. By William Anthony Granville, Ph.D. With the editorial co-operation of Percy F. Smith, Ph.D. New York: Ginn & Co., 1911. 8vo.; 463 pp.; illustrated. Price, $2.50.

This is the revised edition of a work already well and favorably known. The fundamental characteristics of the original work have been retained; but the past few years have marked an advance in the methods of presenting to students the elements of the calculus, and these progressive methods, after triumphantly surviving the proving-ground of the classroom, have been incorporated into the revised drill book. The authors strive to make each step intuitionally as well as analytically evident to the student, and to this end graphics have been liberally employed. There are biographical sketches of the celebrities connected with the history of the calculus, and many examples and problems designed to test the quality of the knowledge at command, and to lead on to a well-grounded understanding. Whether preparing classes for elementary work in applied science, or qualifying them for the more advanced problems of pure mathematics, the teacher has here a wealth of well-arranged material from which to select his lessons and develop his theorems.

THE TEACHING OF GEOMETRY. By David Eugene Smith. New York: Ginn & Co., 1911. 12mo.; 339 pp.; illustrated. Price, $1.25.

Geometry has been the object of many attacks which question the expediency of its inclusion in the mathematical curriculum. It has been condemned as removed from the real problems of human activity, taking up time that might better be devoted to some more practical branch of mathematics. The author, who is a professor of Teachers College, Columbia University, admits the obsolete character of certain portions of the old geometry, and is too fair-minded to attempt a justification of the study as being utilitarian in any narrow sense; yet his chapter, "Why Geometry Is Studied," puts forward some timely and pertinent considerations. Without siding on the one hand with those who would radically alter the body of matter now presented to students, or on the other hand with those who are blindly content with the system as it now stands, Prof. Smith believes in a gradual progression toward a more nearly ideal presentment, and his papers are frankly addressed to those progressive yet well-poised teachers who are striving to invest the subject with vitality and appeal. His purposes are commendable, his ideas well-conceived, and his plans admirably developed in the attractive volume before us.

EVOLUTION. By Patrick Geddes and J. Arthur Thomson. New York: Henry Holt & Co., 1911. 12mo.; 256 pp. Price, 75 cents net.

Taking the evolution theories as the canvas for their picture, the authors unfold before us, with the effect of panoramic distances, long perspectives, and shifting skies, what they have striven to make "a rational vision of world-development." They show us that in spite of the variations of age, sex, origin, groupings, and occupation, every generation has much more in common than its individuals realize. They develop the theme of unity in diversity, of order in the midst of change, until there grows within us a clear conception of the nature of this continuous progression—of this organic and inorganic, individual and social mode to which we give the name Evolution. The biological research stimulated by Darwin made the world almost blind for a time to the pregnant potentials of the social perspective in its application to evolution. The authors avail themselves freely of this source of enlightenment, and cite as a proof of its appeal and usefulness the new eugenic movement. They urge the generalization, in unison, of nature studies and social studies, so that concrete survey and abstract interpretation may meet and merge into a clear-focused projection of the universal development.

SPICES. Their Histories. By Robert O. Fielding. Seattle, Washington: The Trade Register, Inc., 1910. 16mo.; 61 pp.; illustrated. Price, 50 cents.

"Spices" is a reprint in booklet form of several articles originally published in the *Trade Register*. Its information is particularly directed toward retail grocers, and is alphabetically arranged under the various spice-names, each section consisting of a description of the variety, its manner of growth, and its chief uses, with an occasional caution as to the substitutes of the market.

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Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

How Russia Plans to Build Up Her Merchant Marine

To the Editor of SCIENTFIC AMERICAN:

Perhaps no other nation on the face of the earth approaches the United States so closely as does Russia in the basic economic conditions governing the general trend of development of the national industries. Both countries are at present facing a crop of strikingly similar industrial problems of grave moment, arising directly out of the policy of protectionism *per se*. Conspicuous among them looms up the problem of a national merchant marine, which formed the subject of thorough-going study and foreign investigations by agents of the Department of Trade and Manufactures, as well as of repeated turbulent discussions in the national Duma.

The entire session of the Council of Ministers of August 4th was devoted to dissecting various phases of this problem. Legislative measures were laid before the Council, and commercial aspects discussed, looking to the encouragement of national shipbuilding on the one side, promulgation of a foreign merchant marine on the other, and of the Russian export trade in general.

One question was settled with not a dissenting voice, namely, that the idea of promoting national shipbuilding by imposing prohibitory or even discriminating duties on foreign-built ships should be discarded. Like the United States, Russia is at present building enough ships for the coastwise traffic and the internal seas and waterways (*Cabotage*), but Russian-built ships cannot even dare venture into competition with foreign-built vessels outside of the tariff-shielded Russian domains. And precisely like the United States, Russia must have a merchant marine, if it were but to insure the future of the Russian navy. The two phases of the problem were dealt with separately, and two distinct solutions were finally arrived at by the Council, viz.:

Free Ships.—To stimulate Russian foreign navigation and to promote the Russian export trade, saving hundreds of millions annually on carrying freight, passengers, and mails.

Differential Subsidies.—To aid the handicapped Russian shipbuilders to the extent of equalizing as nearly as possible the cost of building them at home and abroad.

Foreign-built ships are to be admitted into Russia free of duty until January 1st, 1928, pending further legislation. On the other hand, two separate scales of differential subsidies were adopted, in proportion to tonnage, for home-built merchant vessels, which are to navigate the foreign seas, as well as the river Danube and its tributaries. The first scale relates to iron steamships; the other provides for iron sailing vessels, including the so-called auxiliary craft.

The subsidies for the first category range from 105 to 65 roubles per ton of gross capacity. Ships of the second category are subsidized to the extent of 84 to 52 roubles per gross ton. In certain specified instances the schedules are modified in reverse proportion to tonnage. Over and above the tonnage subsidies, special subsidies are provided for motive power—whether principal or auxiliary—to the extent of 35 roubles per horse-power indicated. Further subsidies are to be granted for overhauling and installation of new boilers and machinery, at the rate of 1 R. 50 Kps. per pood (36 pounds) for the boilers, and 5 R. 50 Kps. per pood for machinery.

This subsidizing of home shipbuilding is tentatively fixed for the period of fifteen years. The rate of subsidies will remain stationary during the first seven years, whereupon they will be reduced annually by 6 per cent.

With the view of obviating the possible artifices on the part of shrewd foreign shipbuilders, contriving to utilize Russian subsidies to their own advantage, a time limit of three years of Russian service from date of registration of the ship has been fixed. If the ownership of the vessel should be transferred abroad prior to the expiration of this time limit, any subsidies received from the Russian government for construction or overhauling must be refunded in full to the exchequer.

In this way Russia plans to stimulate her export trade, foreign merchant navigation under her flag, and shipbuilding at home. It won't be long before the effect of these measures will become manifest, for the official encouragement in either direction provides sufficiently weighty inducements to promote immediate activity in the field contemplated.

We need not expatiate on the immediate trade-booming effect that the upbuilding of direct shipping between Russia and the United States is bound to produce. The American exports to Russia will go up by leaps and bounds.

In fact, they are going up already, owing solely to the development of Russian steamship traffic from Baltic to American ports. Russia imports over $50,000,000 worth of raw American cotton alone, all of which practically has been handled by the British shipping up to the current year. The establishing of direct steamship service to the Baltic ports has resulted forthwith in a loss to the British shipping trade, amounting to $1,508,000 in the first five months of the current year, and a substantial decline in the volume of the British exports to Russia. For the first time in the history of the American foreign trade, the United States has dispossessed England of her second place among importers to Russia, next to Germany. The British exports to Russia fell off from $27,043,627 in the first five months of 1910 to $24,423,990 for the corresponding period of this year. (This including even the unprecedented advance in the export of woolen yarns, which attained $1,500,000.) In the same time, the exports of the United States rose from $21,043,627 in January to May, 1910, to $28,297,237, respectively, in 1911. *An increase of almost 35 per cent.*

The exports in agricultural machinery went up from $4,867,000 to $8,760,000 (an increase of 80 per cent); other American specialties, from $1,217,000 to $2,920,000. Raw cotton went up to $16 546,000, an increase of $1,703,000.

These figures are so strikingly decisive and pointed as to stand in no need of any elucidating comment.

New York, N. Y. ED. *R. A. M.*

The Merchant Marine Problem

To the Editor of SCIENTIFIC AMERICAN:

Having read your articles on shipping in the special number of the SCIENTIFIC AMERICAN, I feel prompted to bring to your attention a phase of the question not touched upon—the crews.

I will say at the outset that I was originally a "subsidy" advocate, and would not denounce some forms of that scheme yet, in fact would at the time have accepted the bill presented by the late Senator Hanna, in spite of its abuses.

I fully believe a system of subsidies (make it mail subvention, naval reserve subvention, or what you would) would result in an increase in mercantile marine, as witness the German flotilla in which the German government guarantees a dividend of 7 per cent to the North German Lloyd Company, thus enabling it to operate at cost. (Hon. William Bill Sulzer kindly note this.)

So much exaggeration has been made of the evil results of a subsidy scheme, though, that it is useless to try it any longer; further, if we resort to discriminating duties, we must remember that two can play at that game.

The one scheme left is to admit foreign-built vessels (of course, only to be engaged in foreign trade). This would be a good idea, but taken by itself would result in nothing if we did not also admit their crews.

For purpose of illustration, compare a vessel of the same size in four other prominent marine nations with one of ours, for instance, American steamer

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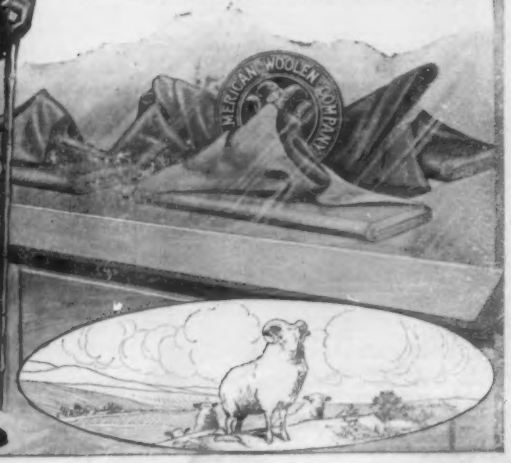

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This may not look so formidable a foe for the American, but the wages of the entire crew of the American boat amount to $16,620 a year its nearest competitor, the British vessel, costing but $10,220 per annum, while the total wages on the Norwegian boat amount to but $6,128 per annum. Under the Hanna bill the "Cherokee" could have earned something between $10,000 and $12,000 per annum, if kept constantly in business; this would have made her capable of competing against even the Norwegian boat.

Suppose we cut the crews of foreign-going American vessels down to the force required of their competitors. Will they work for the same wages or eat the same food the foreigners put up with? The only way I can see to overcome the difficulty is to allow free registry of boat, crew and pantry, and even "load water line," an arrangement which allows boats of some nationalities to take in more cargo than those of other countries.

Another stumbling block is the insurance. We had quite a lot of information about the great influx of American "clippers" on the British registry when that government granted them permission, but so far as I can find there appears to have been only some 20,000 tons of such vessels that changed flags when the British insurance companies came to the rescue of the British shipbuilders and refused to insure either ship or cargo unless the ship were built according to their specifications and under the supervision of one of their agents.

Let us stop scrapping among ourselves and do something, if only to a certain limit. I can see no reason why we should not, for instance, admit to registry "for foreign trade only" all vessels of which a majority of the stock was owned by American citizens on the 1st day of July just past and allow them to have the same officers and crews and standard of feeding as they were required to have under their present flag.

BUSHROD M. GORDON.

Washington, D. C.

The Role of the Cruiser Dreadnought

To the Editor of SCIENTIFIC AMERICAN:

In your issue of October 14th, a letter from Mr. A. B. Irvine brings up the oft-mooted question of battle cruisers, and suggests that the United States construct some of this type immediately or be hopelessly handicapped in a modern naval engagement.

The point at once arises as to whether these 30-knot eight-gun cruisers are to be used only as scouts, as your correspondent seems to think. Ten million dollars is a lot of money to pay for a scout, and to my mind scouting was not the primary purpose of these vessels. The Russo-Japanese war and battle conditions in our own navy have shown that swift 35-knot destroyers with a wide cruising radius are best adapted for scouting, being less easily seen and almost impossible of pursuit. The question of commerce destroying has also been considered, but the presence of a couple of wicked-looking destroyers will bring down the flag of a merchantman as quickly as a cruiser dreadnought.

These vessels are being built by Great Britain, Germany, and Japan, *not as a substitute* for dreadnoughts, but *an addition* to the regular programme, their chief work being to operate together in a flying squadron, capping the enemy's column, throwing it into confusion, if possible, and then retiring, leaving the heavy work to the dreadnoughts.

It is well known that these powerful-looking cruiser dreadnoughts can not stand closer in battle than 10,000 yards to a column of the *same number* of pre-dreadnought battleships such as our "Connecticut" class, on account of their thin armor.

As long as we possess high-speed destroyers equipped with wireless, we need have no fear of not locating the enemy; the disadvantage would appear when the battle was under way. Of course it would be very nice for the United States to have these cruiser dreadnoughts, say one each year, but it would also be nice if we could have more destroyers and the proper number of colliers and other auxiliaries. It is simply a question of money, and being limited in this, it would be folly for the Navy Department to follow any other but its present plan of constructing two super-dreadnoughts a year, equal in power to the latest foreign ships. We will shortly slip back to third place in the naval ranking, and now even this very conservative programme is in danger. No one would think of comparing the cruiser dreadnoughts with our "Washingtons" or "Chesters." We might as well compare the "Oregon" with the "Neptune" of the British navy.

But owing to financial limitations, this type and many other necessary accessories to our battle line will be missing from our building programs for some time to come.

HAROLD M. KENNARD.

Brooklyn, N. Y.

The Pumps Used in Uncovering the "Maine"

IN our issue of September 2nd we published an article on the uncovering of the "Maine." No small share of the credit of the work accomplished is ascribable to the special pumps employed in the performance of the task. These were of the type technically known as the Jeanesville double-suction split-casing pump.

In the double-suction pump, the incoming fluid enters on both sides of the impeller and discharges from the impeller into a common vortex chamber. This double suction construction gives a perfect rotative balance and eliminates all difficulty encountered from end thrust, which is so troublesome in pumps of other designs.

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The Current Supplement

THE question whether other orbs beside our own earth might be inhabited by living creatures is one which appeals to the imagination with peculiar interest. A scientific discussion of the conditions on different celestial spheres with this question in view is given by H. C. Wilson in the current SUPPLEMENT.—A new type of continuously working filter press which is described, should prove of interest to those engaged in industrial operations.—Liquid fuel is now being used in the production of steel. An illustrated article deals with this subject.—Mr. A. C. Rateau writes on the subject of turbines in warships.—We have all heard of the importance of proper mastication of food as a necessary step for a complete and healthy digestion. There are, however, other reasons why thorough mastication is essential to the general health of the individual. This subject is discussed very lucidly in an article derived from the *Dominion Dental Journal*.—An article illustrated with very fine views of the historic Sea of Galilee is contributed by Harold J. Shepstone.—Our Paris correspondent writes on the future of the aeroplane in army service.—An interest-

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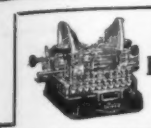

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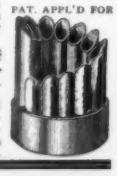

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ing and promising new departure in the field of automatic aeroplane control is the Doutre stabilizer, which is described somewhat in detail.—Some years ago attention was drawn, principally by Gayley, to the advantages obtainable by drying the air used for blast furnaces. Two writers in recent French publications describe a method of drying the air with calcium chloride which offers certain advantages over Gayley's method. An abstract translation of these articles appears in our current issue.—Dr. J. A. Harker of the National Physical Laboratory, Teddington, England, gives a most instructive review of recent advance in high temperature measurement.

Phosphates in the Pacific

IT was thought a few years ago that all the phosphate and guano beds of the Pacific Islands, after yielding millions of dollars worth of fertilizers, were at length exhausted. This view has been changed by the discoveries made since 1907.

The largest phosphate industry that the Pacific ever saw is now in progress on two neighboring islands, the German island of Nauru, the most southern atoll of the Marshall group, and the British island of Banaba. Hundreds of islanders as well as Chinese and Japanese laborers are working in these phosphate diggings, and though the industry is still very young, it is yielding over 2,000 tons of prepared phosphates a year. The yield is increasing as fast as improvements are made in mining the rock and in facilities for shipping it.

The beds in the two islands seem to be similar in the quality of the rock, and though their thickness has not yet been ascertained the quantity of phosphates is enormous. Numerous borings have been made all over Nauru, which comprises about 5,000 acres. These borings were not meant to ascertain the total phosphate content, but merely to determine if there was enough of the rock to pay for the erection of expensive works.

They were sunk, therefore, only to a depth of ten to fifteen feet. The Germans report that under the superficial earth the entire 5,000 acres are covered with phosphate beds to a depth of at least ten or fifteen feet, and they do not know how much deeper the beds may go, for they have not explored lower levels.

They add that it will take some generations to remove the phosphates already revealed. The two companies, German and British, that secured concessions to mine the rock, have joined their interests and are working together. The outside public has nothing to do with their enterprise except to buy the product.

When the German flag was raised over Nauru, twenty-five years ago, the 1,500 natives had no relations with the whites except to sell their cocoanuts for brandy and wretched firearms supplied by two or three unscrupulous traders. The Germans stopped this trade, but it was long before the real wealth of the little island was discovered.

Now a great transformation has come. Large steel framed buildings in which the rock is prepared for commerce have been erected, an iron pier has been extended out into the sea beyond the breakers, and lines of steel tracks lead down from the mines to the piers. But the rock is as yet taken out to the anchored steamships in small boats and the Germans have little hope of discarding this primitive method. They say the surf runs too high for ships to tie up at the landing wharf.

Influence of Chewing on the Condition of the Teeth.—Investigations on the children in the town of Kötzling in Bavaria showed that of those who eat hard bread the percentage with bad teeth was 6.9; of those who eat both hard and soft bread, 8.2; of those eating only soft bread, 10.5. In the town of Ihringen (Baden) the percentages before and after the introduction of soft bread were as follows: In 1894, when only hard bread was eaten, 12.4 per cent; in 1897, just after soft bread had been introduced, 12.9 per cent; and in 1901, where most of the bread consumed was soft, 20.9 per cent.

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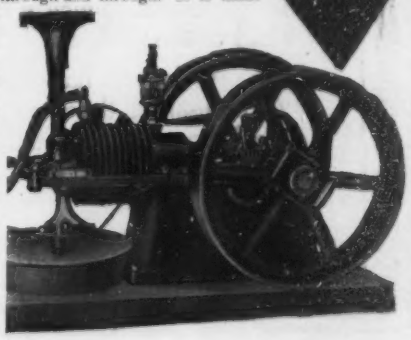

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NAVAL NUMBER

DECEMBER MAGAZINE NUMBER *of the* SCIENTIFIC AMERICAN ISSUE OF DECEMBER 9th, 1911

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Secretary of the Navy

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Rear-Admiral RICHARD WAINWRIGHT, U. S. N. — "The Fleet and Its Readiness for Service"
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Commander Third Submarine Division

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Illustrated by Photographs Taken During the Late Autumn Maneuvers

The period of American history which opened with the Spanish war will always be reckoned as one of the most momentous in the growth of the United States. Then it was that this Republic moved forward into its present commanding position as one of the leading nations of the world.

Two events contributed to this. First: The enormous growth of our industries, far outstripping the demands of home consumption, led to the upbuilding of our present extensive foreign trade. Second: The acquisition of Hawaii, the Philippines and our West Indian possessions, by extending our coast line into distant seas, broke down the geographical isolation of the United States and threw us into an intimate political and military relation with the whole world.

As one immediate result our Navy assumed an importance which it had never before held. The growth of our fleets since 1898 has been steady, and, until the past two or three years has been fairly well adequate to our necessities.

During the period referred to the Scientific American has lent its pages freely to the work of describing the growth of our Navy, and we believe that the intelligent interest in the Navy and its undoubted popularity have been due in no small degree to the efforts of this journal.

As a fitting climax we are in a position to announce that on December 9th we shall issue a magazine naval number, which will be written entirely by leading officials in the Navy, each of whom stands at the head of the particular branch of the service of which he treats.

No journal has ever presented an issue, dealing with naval affairs, of such value and authority as this. A perusal of the above list of writers and subjects will show that this edition will constitute a *brochure* on the Navy, written within the Navy, by its most distinguished officials.

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